DECEMBER, 1959

TRAFFIC ENGINEERING

A Balanced Highway Program for the Nation

A Comparison of Vehicle Operating Characteristics

Median Study

Express Ways

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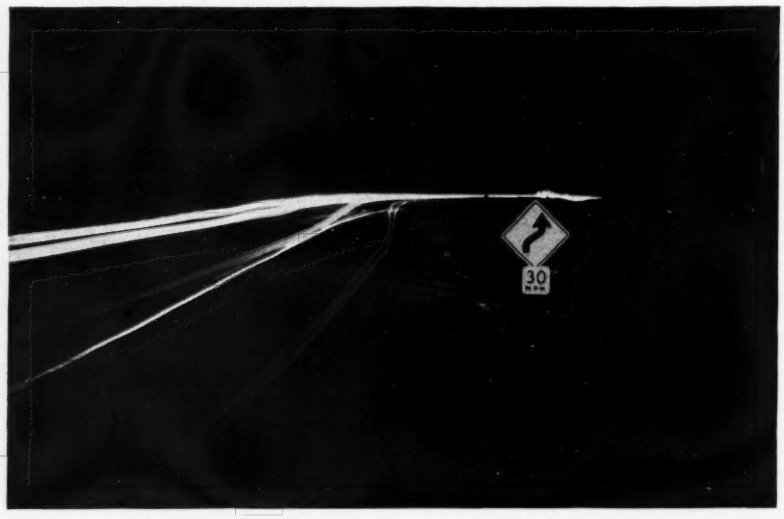

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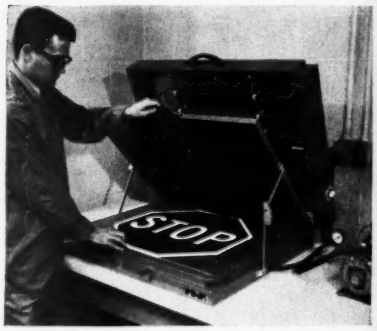

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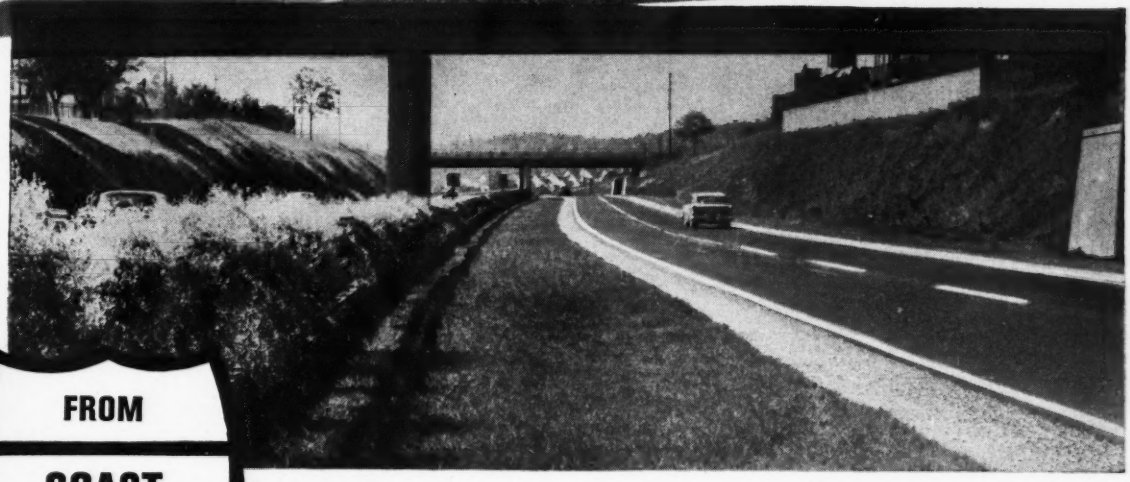

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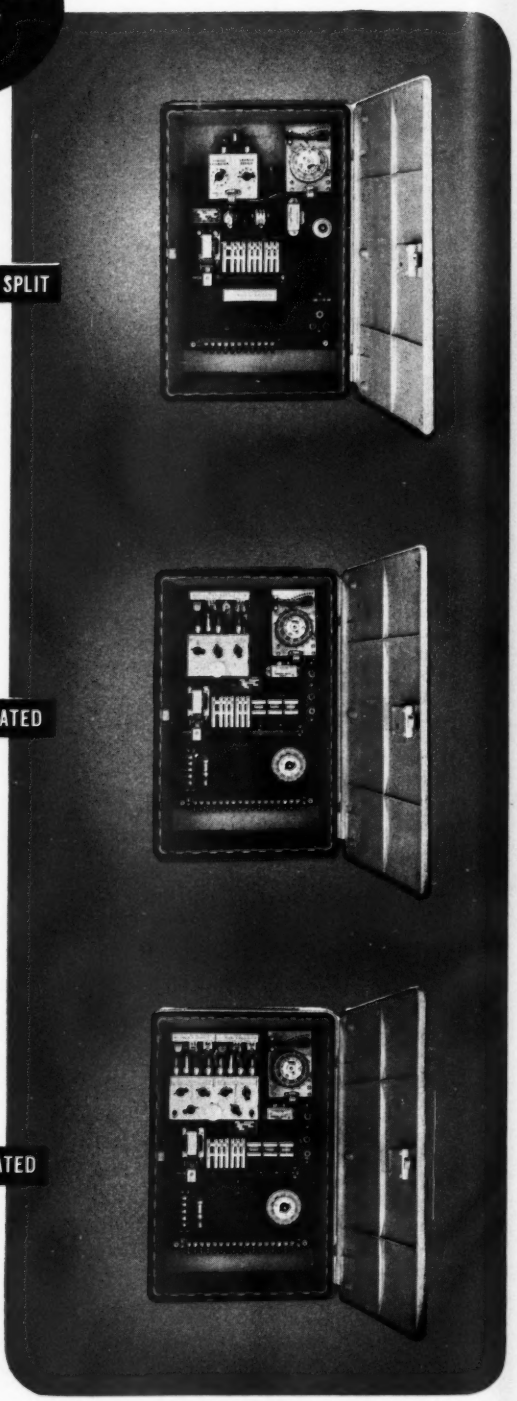

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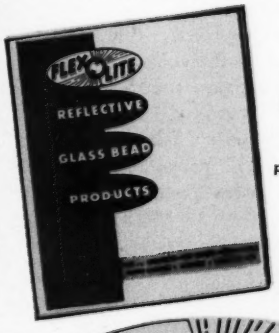

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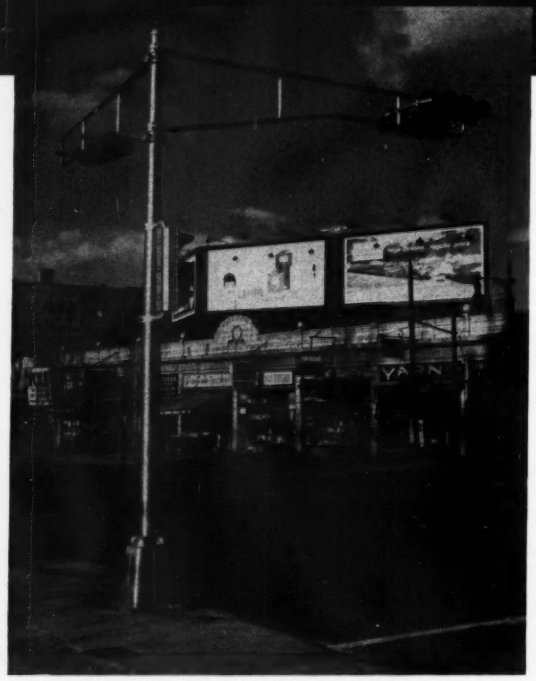

TOP PHOTO: Denver, Colo.; Combination lighting & traffic signal mast arm standards.

BOTTOM PHOTO: Orange, N. J.; Twin trombone arm traffic type standard.

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TRAFFIC ENGINEERING

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CONTENTS

FEATURES

A Balanced Highway Program for the Nation 11
Hon. S. Sloan Colt

A Comparison of Vehicle Operating Characteristics Between Parallel Lane and Direct Taper Types of Freeway Off-Ramps 13
Robert D. Conklin

Median Study 18
George M. Webb

Impact Tests 21
John L. Beaton and Robert N. Field, Jr.

NEWS

Traffic News 30
Coming Events 31
New Appointments 32
New Publications 34
Strictly Business 35

TECHNICAL NOTES

How Many Lives Will Controlled-Access Highways Save? 40

INSTITUTE AFFAIRS

Yearbook Changes 42
TE Handbook Revision 44
Section News 45
Membership Applications 51

MISCELLANEOUS

Positions Available 50
Index to Advertisers 54
Professional Service Directory ..... 54 & 55

COVER: A section of new Interstate Highway in Hillsborough County, Florida, showing service roads at an intersecting highway.

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Frankly Speaking . . .

ONE OF THE MOST NOTICEABLE and gratifying trends in the activities of the Institute of Traffic Engineers is the increasing emphasis placed on technical developments. The Freeway Seminars, the Highland Park Workshop, the recent reorganization and streamlining of the Technical Council, and the establishment of a Technical Development Fund are but a few concrete examples of the importance attached to technical development by the Institute.

Achievements in traffic engineering techniques have not just happened; they have been earned through individual contributions of many and through co-operative efforts with other professional groups, with founder engineering societies, with universities and colleges, with industry and with other agencies. It is not by chance that the word "co-operation" appears in so many of the Workshop recommendations.

Co-operation is a powerful weapon in assuring success in any undertaking, and there is an especially fertile field for fostering technical developments through still greater co-operation with universities and colleges that have established highway transportation research units. These units are staffed with men of high professional status, many of whom are members of the Institute; they are equipped and capable of conducting original research; they have the facilities for sponsoring traffic and planning conferences; and they are an ideal medium for bringing together traffic, design and planning officials, and other allied groups from all levels of government where diverse viewpoints may be resolved and mutual understanding implanted.

Rarely can the traffic engineer find the time to devote to research that it deserves, but he can make a contribution in this field by serving on advisory committees for research projects conducted by universities and colleges and help chart the course of research into areas where it is needed. Such committee service will reap rich rewards for the traffic engineer when his programs and proposals can be supported by factual information from an independent source recognized as unbiased and unprejudiced.

Let us consider the golden opportunities for technical developments through greater co-operation with universities and colleges when the time comes to put in use the resources of the Technical Development Fund. It is not a new idea, but it is a good one.

M. V. GREER
Director, District 5
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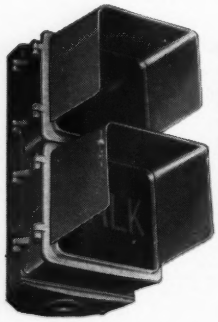

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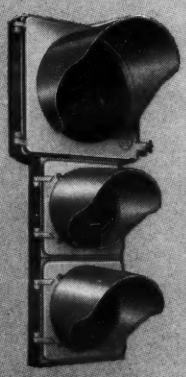

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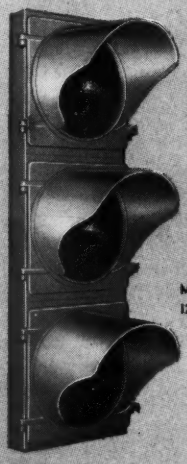

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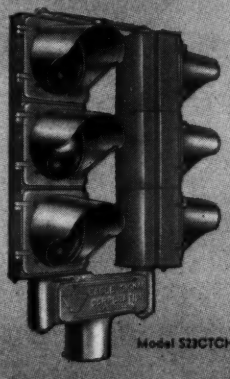

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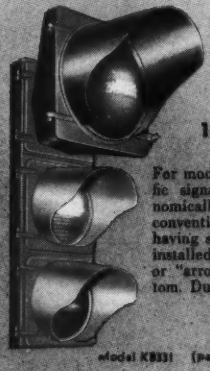

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A Balanced Highway Program For the Nation

By
Honorable S. Sloan Colt, Chairman
The Port of New York Authority

Presented at the
Annual Meeting of the Board of Trustees
The Automotive Safety Foundation
Wednesday, November 4, 1959

CHAIRMAN HOPE, Trustees of the Automotive Safety Foundation, President Mattson and Gentlemen:

I am delighted to have this opportunity to speak to you today on a matter of timely interest to all of us. I refer to a balanced highway program for the nation. It is most appropriate that this subject be considered at this meeting because of the many major contributions the Automotive Safety Foundation has made to the improvement of highway transportation in the United States. Through the Foundation, during these past 22 years, businessmen have joined together to attack head-on the critical problems facing our nation's highway transportation network. The splendid record of the Foundation has established it as a leading force in the promotion of safety, economy and efficiency on our streets and highways.

It was suggested that I should consider speaking here today as a banker, since the Bankers Trust Company has for many years participated in the program of the Automotive Safety Foundation. But with your permission I should like to speak as a former member of the President's Advisory Committee on a National Highway Program, frequently referred to as the Clay Committee.

I should also like to speak as Chairman of The Port of New York Authority. In these two posts, I have had to deal directly with the problems of providing modern highway transportation facilities. And it is these tasks which lead me to speak out today on a matter of deep concern to those of us who are responsible for arterial highway development.

This nation, today, is in the midst of a vast expansion of its highway system. This program was conceived in 1954 by President Eisenhower who recognized clearly that our highway system, to a great extent, was obsolete, unsafe, and inadequate. The Clay Committee, established by the President, was charged with the responsibility of developing a "grand plan for a properly articulated (highway) system that solves the problems of speedy, safe transcontinental traffic — inter-city transportation — access highways and farm to farm movement—metropolitan area congestion—bottlenecks and parking."

With the cooperation and assistance of the staff of the Automotive Safety Foundation, the Clay Committee submitted its report to the President in January 1955. The report recognized that the need for rapid improvement of the Interstate Highway System, including the necessary urban sections, was vital to the nation's welfare. It recommended a ten-year construction program for the 40,000-mile Interstate System at a cost to the Federal Government of approximately 25 billion dollars. The Committee's recommendations led to the current interstate highway construction program which was initiated by the Federal Aid Highway Act of 1956.

I am sure we are all pleased that the Federal Aid Highway Bill enacted during the past session of Congress assures that construction will continue on the National System of Interstate and Defense Highways, even though it will be at a reduced level and will require several more years to complete than originally conceived.

I am, however, greatly disturbed by recent developments concerning certain aspects of the forthcoming review of the Federal Highway Program by both the executive and legislative branches of the Federal Government. Reports indicate that the review will involve consideration of ways and means of reducing the cost of constructing the system, through more austere design or by giving priority to the less costly rural sections of the system. The question of design, of course, is primarily for highway engineers and traffic experts to resolve. However, of overriding importance and of the most serious concern is the suggestion that current construction schedules be altered to de-emphasize urban sections of the interstate system.

Frankly, it is inconceivable to me that consideration can be given to sacrificing the scheduled critical urban highway construction in favor of a priority for rural highways as an economy measure. Such a view loses sight of the basic purpose of this great Federal Highway Program—to provide a safe and efficient highway network essential to the economy of the nation and adequate for the needs of national defense.

There is a clear and apparent need for urban highway construction. The United States is becoming increasingly an urban nation. It is in these urban areas that the majority of the people of this country live, own and drive most of the cars and pay a large part of the taxes which finance the Interstate Highway System. These are the areas that are facing the serious problem of traffic congestion — congestion that would be compounded immeasur-

ably if adequate urban highway capacity is not provided. And it is in these urban areas that lack of arterial highways can strangle the nation's defense industries, commercial activities and economic growth. I must add, too, that the urban highways planned as part of the interstate system will not alone be sufficient at best to solve the total highway problem of today's metropolitan areas. But it is in the metropolitan areas that the need for highway improvements is the greatest and the interstate program is of major importance in this regard.

It can be expected that the trend toward urbanization and its accompanying highway requirements will, without doubt, continue as our population expands and as our metropolitan districts enlarge. By 1975, almost three-fourths of the nation's people will reside in metropolitan areas. These people will own about 60 per cent of the 110,000,000 vehicles expected to be registered in 1975. Metropolitan areas will thus face increasing highway requirements. For example, The Port of New York Authority operates six bridges and tunnels connecting the States of New York and New Jersey as part of the highway complex of the metropolitan area. In 1959 these facilities will handle about 95 million vehicles. By 1975, we expect that the vehicular volume will increase to over 150 million. Similar expansion of traffic is anticipated in all parts of the New York-New Jersey metropolitan area. Nor is this increased traffic to be deplored. It is the result of a dynamic, thriving economy. Urban areas are increasingly the spark-plugs of the economy and their needs must be met if the objectives of the Federal Highway Program are to be achieved.

The interstate highway system is planned to connect all major cities and metropolitan areas of the nation. Certainly these connecting highways cannot end on the fringe of urban areas or merely bypass them. Any new highways built without adequate access to the traffic generating urban areas would be useless and an economic waste. Indeed, any such plan would be compounding the expensive, hazardous bottlenecks which the President specifically aimed at eliminating in formulating his highway program.

Urban highways are located in the areas where the traffic is — over one-half of today's highway traffic is generated in urban areas. And it is these urban areas that contain the industrial concentrations which form the backbone of the nation's strength — both economic and military.

Throughout the country, the development of arterial highways has been a major stimulant to the economy of the areas they serve. Modern highway facilities increase business and industry values; improve the residential attractions of the community; encourage shoppers and recreational driving and contribute to job opportunities and buying power.

The investment in urban highways of the interstate system thus pays rich dividends. To subtract from the scheduled improvements within urban areas in order to add greater "connecting" mileage between urban areas would be self-defeating insofar as dollar for dollar economy and utility are concerned.

The report of the Clay Committee called for a balanced program of modern highways. It was fully aware that this program required expensive urban highway construction and did not hesitate to recommend that "the Federal Government assume primary responsibility for the Interstate network — to include the most essential urban arterial connections." The Committee specifically noted that to "render the Interstate system fully effective, it must be tied in much more closely with existing roads in congested areas." Just for this purpose alone, the connections to the roads of the urban areas, the Committee in its appraisal of minimum needs included $4 billion to be spent over a ten year period.

Similarly, the Clay Committee report noted the relative importance of urban highways. The Committee's report stated that only about 10 per cent of the total highway mileage of the nation is within urban areas but that these highways account for approximately 50 per cent of the total vehicle miles of travel on all highways in the United States. It was estimated, too, that almost one-half of the total expenditures on the Interstate System would be required to be spent in the urban areas to satisfy the needs and to accommodate the increasing pressures of traffic. This forecast has been borne out by the experience of the first few years of the highway construction program, with anticipated expenditures in the urban areas approximating 42 per cent of the cost of the total program.

The need for metropolitan highway improvement is not new. Indeed, it was clearly foreseen as early as 1944, in two separate reports to Congress. One, "The Role of the Federal Government in Highway Development," was prepared by the Automotive Safety Foundation at the request of the Senate Post War Planning Committee, and the other, entitled "Interregional Highways," was prepared by the National Interregional Highway Committee appointed by the President in 1941. Both documents gave special emphasis to the highway needs in urban areas, and the latter report provided the basis for the establishment of the Interstate Highway System which was subsequently authorized by Congress in the Federal Aid Highway Act of 1944. The following statement from the Interregional Highway Report emphasizes the importance of adequate highways to serve large cities and metropolitan areas:

"All facts available to the Committee point to the sections of the recommended system within and in the environs of the larger cities and metropolitan areas, as at once the most important in traffic service and least adequate in the present state of improvement. These sections include routes around as well as into and through the urban areas. If priority of improvement within the system be determined by either the magnitude of benefits resulting or the urgency of need, it is to these sections that first attention should be accorded."

A balanced program of modern highways has now been under construction for over three years. The states have accepted in good faith the expression of Congress to continue this national highway program on schedule, and have provided the necessary manpower and financial arrangements for meeting the state's share of the cost of the program. In fact, many states and some cities that are participating financially in this program have borrowed money through the sale of bonds to finance their share of this program. Consequently, many of these states and cities would be perilously close to serious financial difficulties if the Federal Highway Program provided by Congress and supervised by the Bureau of Public Roads with the cooperation of the State Highway Departments were to de-emphasize the urban portion of the over-all program.

(Continued on page 39)

The 1959 Past Presidents' Award Paper

A Comparison of Vehicle Operating Characteristics Between Parallel Lane and Direct Taper Types of Freeway Off-Ramps

By Robert D. Conklin
Traffic Investigation Engineer
Oregon State Highway Department

THIS STUDY indicated that vehicle operating characteristics were superior on the direct taper type of off-ramp than on the parallel lane type off-ramp. Vehicles using the direct taper type off-ramp consistently left the freeway at about the same location and in the manner in which it was designed, thereby affording a smoother and more orderly movement of traffic. Vehicles left the freeway at relatively high speeds, thereby reducing the possibilities of accidents attributable to vehicles traveling at different speeds. The parallel lane type off-ramp was used in many different manners. This varied from full use of the deceleration lane, according to the design, to virtually no use of the deceleration lane. It was observed that the majority of motorists decelerated, to varying extents, partly or entirely on the freeway proper, which creates an accident potential.

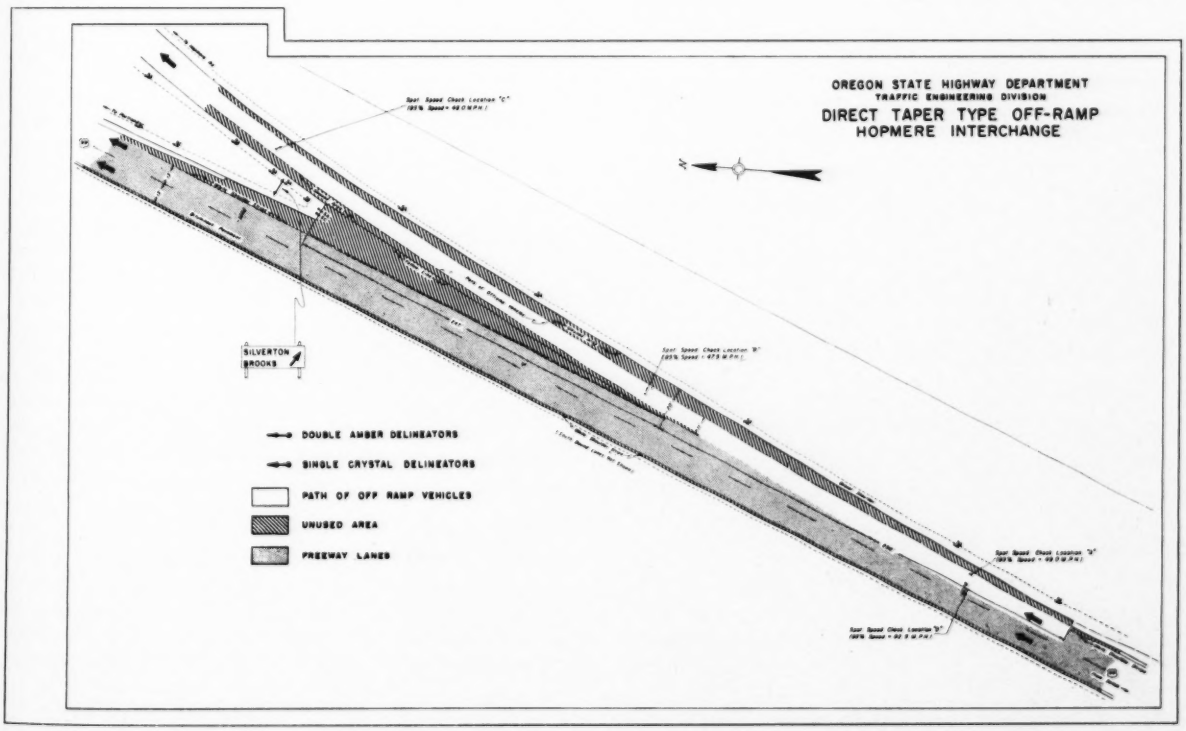
General

There has been considerable discussion of the relative merits of the standard parallel deceleration lane and direct taper types of off-ramp connections for freeway interchanges. The purpose of this study was to attempt to compare the operating characteristics of the two types of ramps.

Study Locations

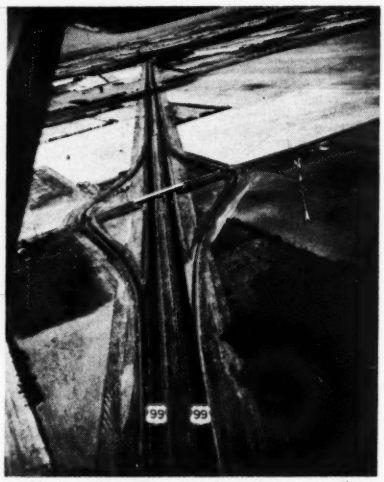
Both of the locations studied are on the R. H. Baldock Freeway, a part of the Interstate Highway System between Salem and Portland. This freeway is four lanes in width with a wide natural median. The shoulders are paved and edge stripes have been painted. The design speed of the freeway is 70 mph. The indicated speed for passenger vehicles is 70 mph, and trucks operate under an absolute speed limit of 50 mph. There are no exit speed indications. Pavement markings at the ramps consist of an adaptation of the Interstate Standards. There are amber delineators at both study locations. The grade is approximately level at both study locations.

The Hopmere Interchange is of the conventional diamond design and has the direct taper type of take-off. The northbound off-ramp at this interchange was selected for study. The angle of take-off is 4° 10′ or about 14 to one. The length of opening, meas-



ured longitudinally along the freeway, is 527 feet. Lines have been painted from the gore point for a distance of 247 feet, which leaves an opening of 280 feet from the beginning of the off-ramp with no painted lines. There is a 4° 12′ curve on the off-ramp beyond the gore point.

The Nyberg Road Interchange is of the partial cloverleaf design with the loops located on the approach side of the structure. The off-ramps at this interchange have parallel type deceleration lanes. The southbound parallel lane type off-ramp studied is 470 feet long including taper. There is a horizontal curve near the gore point which has a radius of 138 feet. This interchange is illuminated.



Looking north at Hopmere Interchange — direct taper type off-ramp studied in lower right quadrant.

Procedure

The procedure used consisted of the taking of speed checks with portable radar units at the beginning, center and near the gore point of the off-ramps. Also measured was the speed of through vehicles in the outside lane of the freeway. The minimum speed sample was 100 vehicles.

In addition to the speed measurements, the lateral placement of vehicles using the off-ramps was also studied. One portion of the study consisted of setting up a movie camera pointed parallel to the freeway and parallel to the ramp and filming the operation of vehicles on each ramp. The ramp and deceleration areas were then sprinkled with finely crushed rock which was allowed to lie for approximately one week. The resulting "sand pattern" was then photographed from the air. A field survey was also made and the pattern was plotted on a plan of the off-ramp. As a portion of the lateral placement study, the location at which off-ramp vehicles cleared the outside lane of the freeway was also determined.

Discussion

Traffic volume data and the results of the speed studies are summarized in Table 1.

The speed checks taken on the direct taper type off-ramp indicated that vehicles do virtually all of their deceleration well away from the freeway proper. The aforementioned table indicates that the 85 percentile speed decreased only 3.0 mph between the beginning and the gore point of the direct taper off-ramp, which indicates that off-ramp vehicles do most of their deceleration past the gore point. The 85 percentile speed was only 23.5 mph at the gore of the parallel lane type off-ramp due to a horizontal curve with a radius of 138 feet. The horizontal alignment of the direct taper off-ramp studied did not restrict the speed of vehicles. From the speed data it can be assumed that the parallel deceleration lane type off-ramp, because of the greater speed differential between through and ramp vehicles, causes a greater degree of traffic friction.

The validity of comparing the speeds of these two different types of off-ramps may be questioned due to the horizontal curve on the parallel lane type off-ramp which limits the speed. It should be pointed out, however, that an inherent feature of a parallel

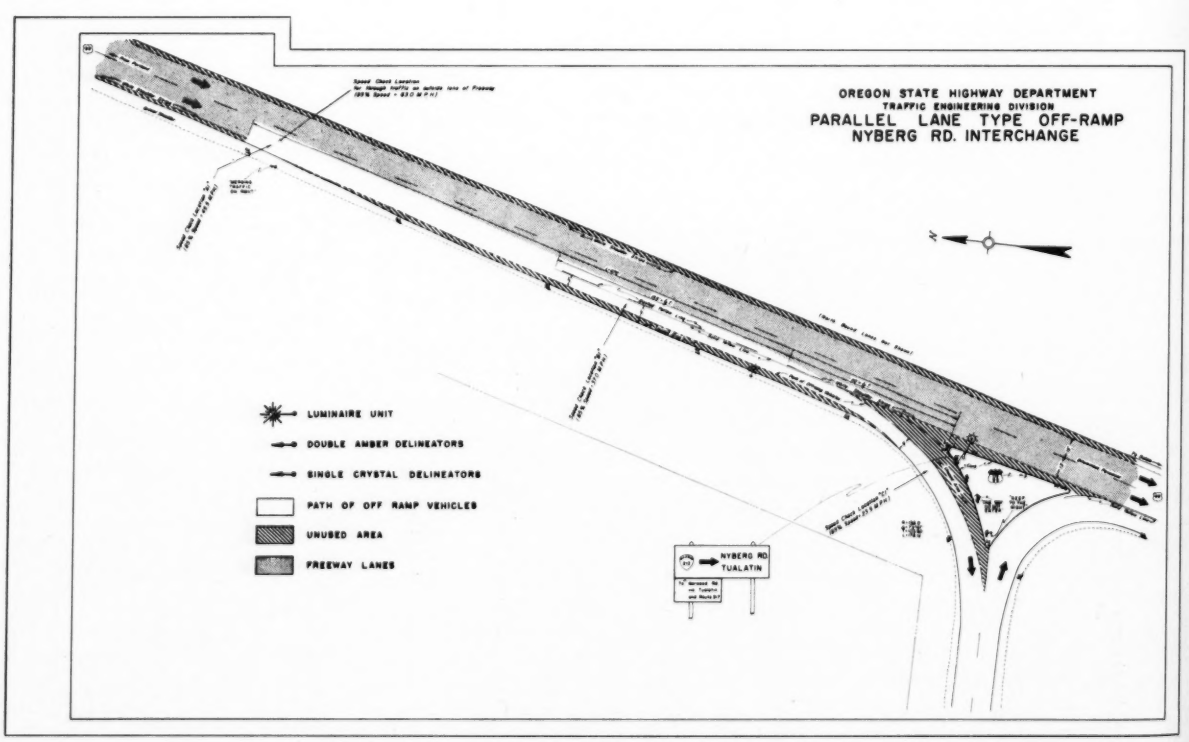


TABLE 1

Item	Direct Taper Off-Ramp, Hopmere	Parallel Lane Off-Ramp, Nyberg
1957 ADT on Freeway—One Direction	3,900	4,900
1957 ADT on Off-Ramp	200	400
85% Speed on Off-Ramp:[1]		
Beginning of Off-Ramp (Sta. A)	49.0	45.5
Middle of Off-Ramp (Sta. B)	47.5	37.0
Gore of Off-Ramp (Sta. C)	46.0	23.5
Pace Limits:[2]		
Beginning of Off-Ramp (Sta. A)	38-48	35-45
Middle of Off-Ramp (Sta. B)	36-46	27-37
Gore of Off-Ramp (Sta. C)	33-43	15-25
Percent in Pace:		
Beginning of Off-Ramp (Sta. A)	59	67
Middle of Off-Ramp (Sta. B)	58	71
Gore of Off-Ramp (Sta. C)	61	90
Maximum Speed:		
Beginning of Off-Ramp (Sta. A)	63	50
Middle of Off-Ramp (Sta. B)	62	43
Gore of Off-Ramp (Sta. C)	55	32
85% Speed of Through Traffic on Outside Lane of Freeway:[1]		
Passenger Cars	62.5	63.0
Trucks	50.5	52.0

1. Speed at or below which 85% of the passenger vehicles traveled.
2. Ten-mile per hour range containing the largest number of passenger vehicles.

lane type off-ramp is a relatively sharp horizontal curve near the gore, whereas the horizontal alignment on the direct taper type off-ramp is normally much less severe. For this reason, a qualified comparison of speed data is felt justified, particularly near the beginnings and midpoints of the off-ramps.

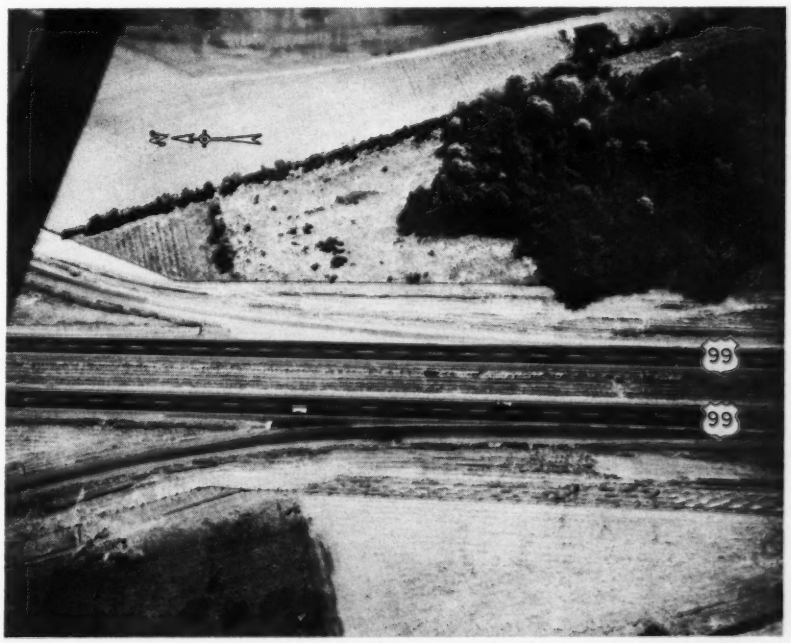
The 85 percentile speed near the middle of the off-ramp was 47.5 mph on the direct taper type and 37.0 mph on the parallel lane off-ramp. Virtually all of the vehicles were completely off of the freeway proper at the midpoint of the taper type but well over one-half of the vehicles were partly or completely on the freeway proper at the midpoint of the parallel lane type. The speed differential between the through traffic on the outside lane of the freeway and the middle of the off-ramp was 15.0 mph on the direct taper type and 26.0 mph on the parallel lane type off-ramp. This indicates that the likelihood of rear-end collisions on the parallel lane type of off-ramp is definitely greater than on the direct taper type of off-ramp.

According to modern design standards, the exit speed should be seven-tenths of the freeway design speed. It is interesting to note that the 85 percentile speed of off-ramp traffic at the beginning of the direct taper type of off-ramp was 49.0 mph, which meets this criterion exactly.

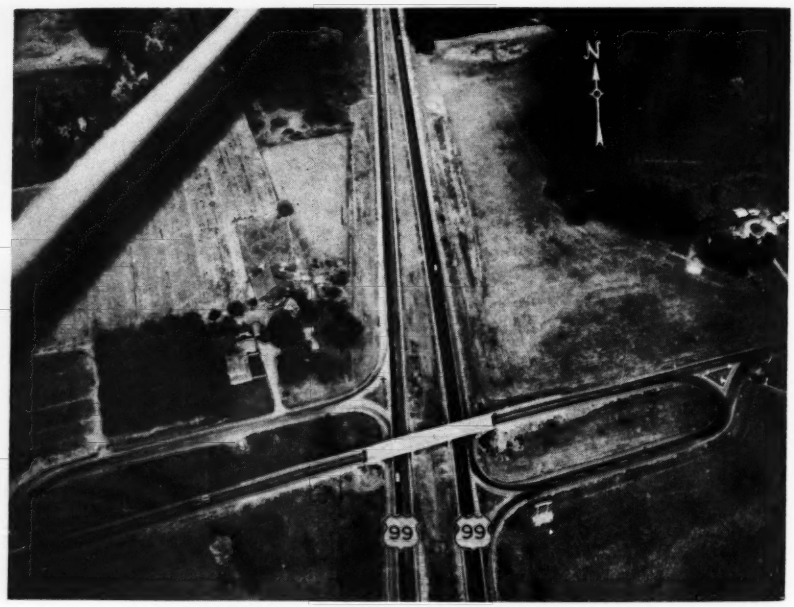
Speed checks taken at other locations on the freeway between interchanges reveal that the 85 percentile speed was 66.5 mph for the outside lane and 70.5 mph for the inside lane. It appears that through traffic slows down at interchanges about three miles per hour on the outside lane and one mile per hour on the inside lane.

The vehicle placement portion of this study indicated that on the direct taper type off-ramp the path of the off-ramp vehicles was only 11 feet wide throughout as determined by the "sand pattern." Ninety-eight per cent of the off-ramp vehicles cleared the outside lane of the freeway in the first 280 feet of the off-ramp. The plan shown illustrates that vehicles followed the painted lines, which extend from the gore, very closely.

On the parallel lane type off-ramp, 20 per cent of the off-ramp vehicles cleared the outside lane of the freeway and made the reverse curve onto the deceleration lane near the beginning 200 foot section according to the method it was designed. Forty-seven per cent of the vehicles made a direct connection onto the deceleration lane and cleared the freeway proper in the middle 140 foot section. Thirty-three per cent of the vehicles made a delayed entrance onto the deceleration lane and cleared the outside lane of the freeway in the last 130 foot section next to the gore. It appeared that the motorist who made the delayed entrance did so in order to obtain a more direct approach to the horizontal curve. The "sand pattern" made by off-ramp vehicles indicated that there was 380 feet, measured longitudinally to the



Gravel path on direct taper type off-ramp (Hopmere Interchange) in upper portion of picture.

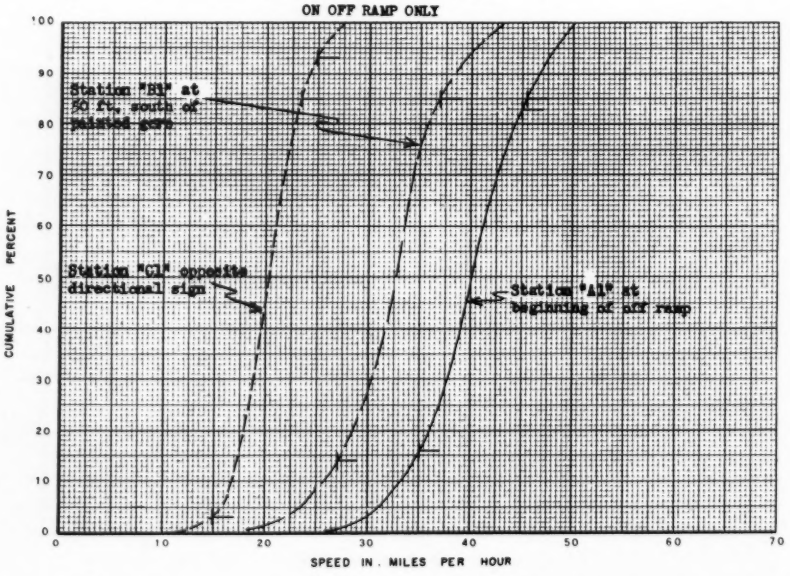


Looking north at Nyberg Road Interchange— parallel lane type off-ramp studied in upper left quadrant.

OREGON STATE HIGHWAY DEPARTMENT
TRAFFIC ENGINEERING DIVISION
PASSENGER VEHICLE SPEEDS

HIGHWAY ROUTE NO. US99 — DATE 9-19-58
HIGHWAY NO. 57 — TIME 10:15 AM TO 3:10 PM
MILE POST 11.80 — WEATHER CONDITION Cloudy & Dry
GENERAL LOCATION Southbound Off Ramp — NUMBER IN SAMPLE 100
of Nyberg Road Interchange ——— BOUND
——— BOUND

PARALLEL LANE TYPE OFF-RAMP
ON OFF RAMP ONLY



ITEM	A1 Southbound	B1 Southbound	C1 Southbound
85% SPEED	45.5	37.0	23.5
PACE LIMITS	35-45	27-37	15-25
% IN PACE	67	71	90
MAX. SPEED	50	43	32

freeway, used by off-ramp vehicles on the parallel lane type as compared to 260 feet on the direct taper type. The path of the off-ramp vehicles was about 16 feet wide in the first portion of the parallel lane type off-ramp and narrowed down to a width of nine feet near the gore. Motorists cut to the inside of the turn on the parallel lane off-ramp and did not utilize 12 feet of pavement adjacent to the curbed gore. There appeared to be a general reluctance of the majority of the motorists to make the required reverse curve at the beginning of the parallel lane type off-ramp, in order to properly use this type of facility. Those motorists who used the facility properly only utilized seven feet of pavement adjacent to the edge of the freeway lanes, which undoubtedly restricts the use of the freeway.

The movies taken at these two different types of off-ramps illustrate that off-ramp vehicles on the parallel lane cause considerable more friction with through freeway traffic than occurs on the direct taper off-ramp. There were a large number of cases where freeway traffic would move into the median lane when there was a vehicle using the parallel lane off-ramp. If this freeway was operating at near capacity, this detrimental effect would be much more apparent and would result in more congestion and traffic hazard.

Conclusions

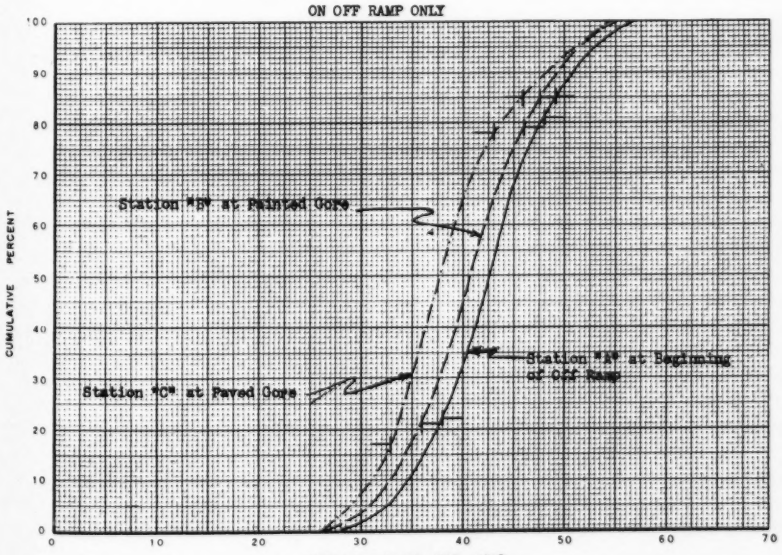
The results of this study indicate that the direct taper type off-ramp is definitely superior to the parallel lane type, both in speed of operation and the placement of vehicles. Traffic on the parallel lane type off-ramp interfered with the use of the freeway proper to a much greater extent than on the direct taper type off-ramp which is illustrated by the movies. The direct taper off-ramp follows very closely the path that motorists desire to follow. The reverse curve that is necessary in order to properly utilize the parallel lane type off-ramp, apparently appears awkward and inconvenient to the majority of the motorists, and thereby partially defeats the purpose of this type of design. Motorists who made the delayed entrance on the parallel lane type off-ramp appeared to do so in order to obtain an easier and more direct approach to the horizontal curve. This hazardous practice could be eliminated by making the gore approximately 100 feet ahead of the beginning of the horizontal curve.

Gravel path on parallel lane type off-ramp (Nyberg Road Interchange) in lower right portion of picture.

OREGON STATE HIGHWAY DEPARTMENT
TRAFFIC ENGINEERING DIVISION
PASSENGER VEHICLE SPEEDS

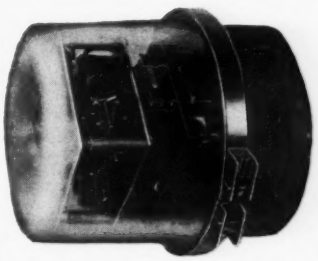
HIGHWAY ROUTE NO. I599 — DATE August 8, 11, 12, 1958
HIGHWAY NO. 57 — TIME -- M TO -- M
MILE POST 38.17 — WEATHER CONDITION Clear - Dry
GENERAL LOCATION Northbound Off Ramp of the Hopmere Interchange — NUMBER IN SAMPLE 100
_____ BOUND
_ _ _ _ _ BOUND

DIRECT TAPER TYPE OFF-RAMP
ON OFF RAMP ONLY



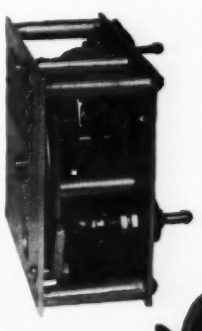
ITEM	"A" Northbound	"B" Northbound	"C" Northbound
85% SPEED	49.0	47.5	46.0
PACE LIMITS	38-48	36-46	33-43
% IN PACE	59	58	61
MAX. SPEED	63	62	55

TIME-O-MATIC
FLASHERS
JACK MOUNTED

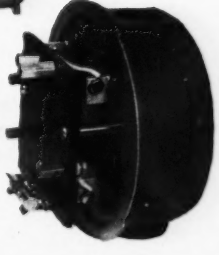


Time-O-Matic Jack Mounted Flasher in Standard Meter Case

Single or two circuits, every model with built-in eliminators. Available with standard meter case (above) or separately with Jack mounting panel (below).



Time-O-Matic Jack Mounted Flasher Only



Time-O-Matic Jack Panel in Meter Case

SPECIFY DEPENDABLE TIME-O-MATIC CONTROLS

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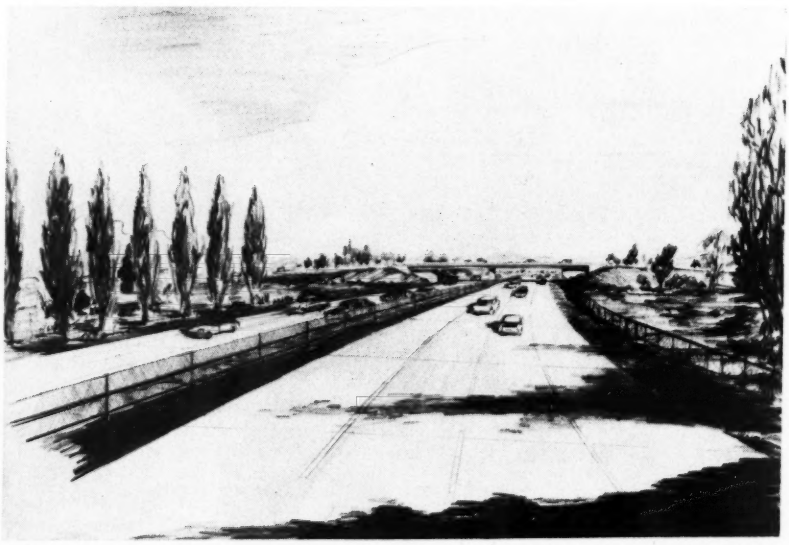
Median Study

Research Project Determines Effect Of Barrier Design on Accident Rate

By George M. Webb
Traffic Engineer
California Division of Highways



This drawing shows a new type of median barrier which will be installed in the center strip of some of the State's more heavily traveled freeways. The new barrier design was developed by division structural and materials experts during a series of full-scale crash tests. It is only one of 15 types tested. The design utilizes chain link fence, light steel posts, and three ¾-inch steel cables.

THE DIVISION of Highways has completed a new safety study dealing with accidents, particularly the infrequent but usually serious cross-median head-on collisions, on California's heavily traveled freeways, expressways and other divided highways

The extensive study was the first of its kind and scope covering accidents on divided highways with extremely heavy traffic.

Purpose of the research project was to determine the effect of various median designs on accident rates, and to find the conditions under which a positive median barrier may aid in reducing the accident toll.

Included was a statistical and engineering analysis of 8,000 accidents which occurred on 265 miles of various types of divided highways in 1956 and 1957, plus a close examination of 407 fatal freeway crashes in the last three years. Special attention was given to cross-median accidents.

Divided highways chosen for the study were essentially limited access facilities — freeways, expressways or routes without roadside development— which carry an average from 15,000 to 200,000 vehicles a day. A similar study in 1952 dealt with average daily traffic volumes up to 25,000 vehicles.

Related Study Made

The study was made in conjunction with a series of radio-controlled crash tests, conducted by the Materials and Research Laboratory in Sacramento, in which new median barrier designs were developed. The impact tests and new barrier designs are described in another article in this issue.

As a result of this research, the new types of barriers will be installed shortly on sections of the Hollywood, Santa Ana, Ventura, and San Diego Freeways in the Los Angeles area, and the James Lick (Bayshore) and Nimitz Freeways in the San Francisco Bay region.

If experience with these initial installations proves successful, barriers will be installed on other heavily traveled freeways.

In reporting some of the principal findings of the safety study, it should also be emphasized that scores of recent highway engineering advances are incorporated in today's modern freeways, making this type of highway the safest ever known.

However, it is doubtful that anyone will ever come up with a completely accident - proof highway, and consequently safe driving practices and motoring courtesy will continue to be the most effective weapons in the fight against traffic accidents.

Categories Described

For the purposes of the safety study, various median designs were placed in two categories — "deterring" or "nontraversable."

The deterring types include many of the earth medians, the raised bar or low dike facilities, and the center strips with mountable double curbs.

The nontraversable category includes medians with barriers, and non-mountable curbs, separate roadways, and earth medians with a continuous obstruction or with steep slopes. In addition, all medians more than 100 feet wide were classified as nontraversable.

Part One of the safety study involved an analysis of 8,000 accidents which occurred over a two-year period (1956 and 1957) on the 265 miles of divided highways selected for the study.

Among the items considered in this

Reprinted from "California Highways and Public Works," July-August, 1959.

portion of the study were the influence of traffic volume on the accident rates for highways with both types of median, and the influence of the median design on the type and severity of accidents.

Statistics were developed which indicated that operating conditions, as measured by average daily traffic, made a difference in the relative safety of routes with deterring medians and those with nontraversable medians.

In the volume range from 15,000 to 130,000 vehicles a day, nontraversable median designs had higher overall accident rates and higher injury (includes fatalities) rates. As expected, the nontraversable medians had fewer head-on accidents than deterring medians, but the higher rates for overtaking and single vehicle accidents more than offset this advantage. In this volume range, head-on accidents account for 1/25 of all accidents and 1/21 of the injury accidents.

On highways carrying more than 130,000 vehicles a day, the nontraversable medians showed lower rates than the deterring type for both injury accidents and all accidents.

Past Studies Noted

The findings of this portion of the study coincide with those of two before-and-after studies of freeway sections where barriers have been installed in the past.

Since 1951, the division has made three such before-and-after studies. The accident rates decreased after a steel guardrail was placed in the median on a section of the James Lick Freeway in San Francisco; however, the results were much different in the two other cases.

On the San Bernardino Freeway in Los Angeles, the accident rate jumped 75 per cent and the injury rate increased 116 per cent after a median barrier was installed. On the Grapevine Grade (US 99) in Kern County, the accident rate went up 88 per cent and the injury rate climbed 53 per cent in the after period.

In view of the unfavorable record of barriers in two of the before-and-after studies and also in the new 265-mile study, it is worthwhile to examine some of the probable reasons for the adverse effect of barriers installed in the past.

First, the introduction of a physical barrier in a traversable or deterring median *reduces the usable width of the median*, thereby limiting the space available to motorists for emergency maneuvers and parking in the center strip. There are undoubtedly a large number of vehicles which enter and in some cases cross the median without being involved in an accident. More important, perhaps, is the fact that stalled vehicles are frequently parked in median areas.

In addition, collisions with barriers, such as those used in the past, may mean serious injuries to occupants of a vehicle, or result in other collisions as a vehicle bounces back into the traffic stream.

Curbed or Earth Medians

These are probably the main reasons why Part One of the study indicates that a nontraversable barrier median is not as good as the curbed or earth median from the standpoint of overall traffic safety or severity of accidents, except on highways carrying extremely heavy traffic.

As a corollary to the accident analysis of Part One, the second phase of the study covered only the 407 fatal accidents which happened on the State's full freeways in 1956, 1957 and 1958. Emphasis was on the fatal cross-median accidents.

The purpose was to determine a basis for dealing with the problem of the infrequent but usually serious cross-median collision through the use of median barriers.

In connection with this part of the study, it is appropriate to note that 10 times as many fatal head-on accidents occur each year on conventional roads, streets and highways in California as occur on the State's freeways. Nearly all such crashes on both kinds of highway are the result of driver error or negligence.

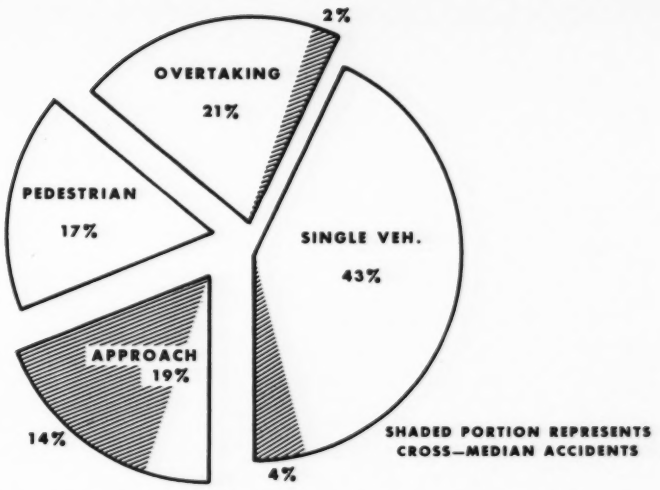
While many people are inclined to attribute head-on crashes which happen on ordinary roads, streets and highways to speed, drinking, immaturity or some other driver factor, the comparatively few which occur on freeways are often blamed on highway design.

The factual study reveals this widespread impression to be a fallacy.

Pedestrian Rate High

As a starting point for the second portion of the study, fatal freeway accidents were classified according to type. As shown in the accompanying chart, 43 per cent of the fatal accidents in the three-year period involved only *one vehicle;* an *overtaking* collision was responsible for 21 per cent of the fatal accidents; and *pedestrians*, most of them illegally hitchhiking or using the freeway as a footpath, were involved in 17 per cent of the fatal mishaps. (See "pie" chart.)

About 19 per cent of the fatal smash-ups were the approach type. This includes crashes brought on by wrong-way drivers, as well as head-on accidents in which a car or truck crossed the dividing strip.



TYPES OF FATAL ACCIDENTS ON FREEWAYS 1956, 1957, 1958

This chart shows the types of fatal accidents on California freeways during 1956, 1957 and 1958. The shaded portion represents cross-median accidents.

UPPER—The effectiveness of various median designs was evaluated in a recent Division of Highways safety study. Medians with barriers, such as this one on the James Lick Freeway in San Francisco, were among those classified as nontraversable. LOWER—This type of curbed center strip on the Hollywood Freeway in Los Angeles was one of the deterring median designs included in a recent Division of Highways safety study.

The number of fatalities resulting from each type of accident was also recorded. Forty-two per cent of the fatalities resulted from single-vehicle accidents; 20 per cent from overtaking accidents; 24 per cent from approach accidents of all types; and 14 per cent from pedestrian mishaps.

Crossings of the median were present in 55 of the approach type fatal accidents, seven of the overtaking type, and 15 of the single-vehicle fatal accidents. (See shaded areas in chart.)

It should be explained that the accident classification is determined by the first event. Thus, the cross-median overtaking accidents involved an overtaking collision before the vehicle crossed the median.

Cross-Median Crashes

A significant fact derived from the classification of accidents was that the 62 cross-median collisions of two or more vehicles accounted for 95, or about one-fifth of all fatalities on freeways during 1956, 1957 and 1958. (During the same years there were 11,005 traffic fatalities on all types of streets, roads and highways in the State.)

The next step was to attempt to find the conditions under which cross-median collisions of two or more vehicles are most likely to occur.

The large majority of these accidents, it was learned, happened on sections of a relatively few heavily traveled freeways. In fact, two-thirds of all the fatal cross-median collisions occurred on routes which carry more than 60,000 vehicles a day.

Thus, to make a significant attack on the problem of cross-median collisions, consideration should be given to the installation of barriers on freeways with average daily traffic of more than 60,000 vehicles.

This poses a dilemma, since the first part of the study, as well as past experience, shows that barriers may have a detrimental effect on accident and injury rates, except on routes which carry more than 130,000 vehicles a day.

The answer to this dilemma may be found in the operating effectiveness of the new types of barriers developed by the Materials and Research Laboratory in the course of the impact tests.

Barrier Requirements Listed

To be an effective aid to safety, a median barrier must meet very exacting requirements. It must, of course, prevent crossings of the median; but it must also absorb high speed impact in such a way as to minimize possible injuries to occupants of the vehicle and reduce the danger of the vehicle bouncing back into the traffic stream.

Barriers installed in the past have not been satisfactory in meeting all of these requirements, the crash tests revealed. The new designs, however, appear to be more effective, particularly in reducing the severity of collisions with the barrier.

This leads to the encouraging belief that the new barriers will prove to be beneficial under actual operating conditions on heavily traveled freeways.

Impact Tests

Barrier Test Crashes Reveal Valuable Data

By John L. Beaton
Chief, Structural Materials Section, and
Robert N. Field, Jr.
Materials and Research Engineering Associate
California Division of Highways

THE DIVISION of Highways has had a comprehensive study of median barriers underway for the past several years. This article will describe one phase of this study — the actual dynamic testing and development of positive barriers for use in the median (center) strips.

It was the purpose of this study to develop a median barrier which would both prevent a high-speed vehicle from getting into the opposite lanes of traffic and to reduce the severity at the same time so far as possible of the accidents which result from a vehicle striking a barrier. It was therefore considered in the order of their importance that the following three functions should be considered to be primary features of a median barrier: (1) positiveness of preventing crossing of the median; (2) minimizing reflection of the offending vehicle back into the traffic stream; and (3) minimizing injury to the occupants of the offending vehicle. This dynamic phase of the study was initiated by the Traffic, Design and Bridge Departments and approved by the State Highway Engineer on January 9, 1958. All work was guided by the Median Barrier Committee which consisted of members of the Traffic Design, Bridge, and Materials and Research Departments. This Committee originally approved the testing of three designs of bridge rails and 15 median barrier designs.

With all preliminary planning, instrumentation, and construction concluded during the spring of 1958, the first test was performed on July 10, 1958. The test site was an inactive runway of the Sacramento County Airport located near Franklin, California. Figure 2 shows a plan of the test site. Each test was conducted by first building the selected barrier design, duplicating field conditions as nearly as possible but yet retaining all factors under control so that each test would be as comparable as possible.

Figure 1
A 34-passenger bus is test-crashed into a cable-chain link barrier at 40 mph.

Factors Consistent

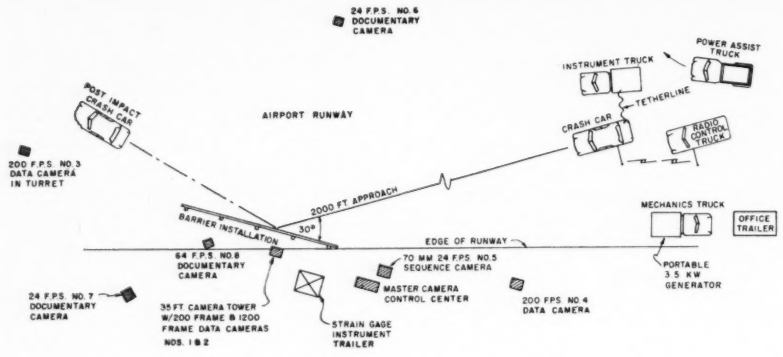
The crash car was driven into collision by remote radio control from a pilot car following to the rear and left of the test automobile as shown on Figure 2. All of the preliminary tests were conducted by driving a medium-weight four-passenger sedan automobile into the various test barriers at an approximate speed of 60 m.p.h. and at an angle of collision of 30°. This same weight of car, speed, and approach angle was used consistently within practical limits so as to obtain as good a comparison as possible between the various designs.

The preliminary tests were made on each of the original 15 barrier designs. Additional final tests, using both an automobile and a 34-passenger bus, were conducted on the two designs judged to be most efficient during preliminary testing. (The two most efficient designs are shown in Figures 4 and 5. Twelve other types are included in Figure 3; the design not shown was a modification of Type IV.)

The bus was driven into the barriers at 40 m.p.h. and an angle of 30°. The bus at 40 m.p.h. represented slightly more than twice the kinetic energy developed by the cars at 60 m.p.h. (Figure 1).

Since the primary aim of this study was to test the resistance of the various barriers, it was important that a severe type of oblique accident be employed.

Reprinted from "California Highways and Public Works," July-August, 1959.


24 F.P.S. NO. 6 DOCUMENTARY CAMERA
POWER ASSIST TRUCK
INSTRUMENT TRUCK
TETHERLINE
POST IMPACT CRASH CAR
AIRPORT RUNWAY
CRASH CAR
RADIO CONTROL TRUCK
200 F.P.S. NO. 3 DATA CAMERA IN TURRET
2000 FT APPROACH
MECHANICS TRUCK
OFFICE TRAILER
BARRIER INSTALLATION
30°
EDGE OF RUNWAY
64 F.P.S. NO. 8 DOCUMENTARY CAMERA
70 MM 24 F.P.S. NO. 5 SEQUENCE CAMERA
PORTABLE 3.5 KW GENERATOR
MASTER CAMERA CONTROL CENTER
200 FPS. NO. 4 DATA CAMERA
24 F.P.S. NO. 7 DOCUMENTARY CAMERA
35 FT. CAMERA TOWER W/200 FRAME & 1200 FRAME DATA CAMERAS NOS. 1 & 2
STRAIN GAGE INSTRUMENT TRAILER

PLAN VIEW OF TEST SITE

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Figure 2
A plan view of the test site. The crash car was driven into collision by remote radio control from a pilot car following to the rear and left of the test automobile as shown above.

At the same time it was felt that the type of accident selected should not be beyond the realm of actual occurrence on a highway. The selection of the angle and speed of the test collision was based on this reasoning supplemented by a background of studies of many actual cross-median accidents as well as through analyzing this department's past experience with the many different speeds and angles of approach which were used during dynamic testing of bridge curbs and rails in the past. Thus it was decided that the 60 m.p.h. speed and the 30° angle of approach combination used for the standard passenger car test vehicle is representative of this severe type of oblique accident. With two exceptions this combination was used throughout the test program.

Approach Angle Varied

Since the majority of actual collisions with roadside railings and barriers usually occur between the angles of 15° and 20°, it was decided that at least one or more tests should be made at a lower than 30° angle of approach. Thus two such exceptions to the 30° approach were made so as to determine the change in reaction of the barrier due to the flatter angle of collision.

An anthropometric dummy restrained by a seat belt occupied the driver's seat of the test car during all collisions. Longitudinal and lateral deceleration recordings were taken from accelerometers located in the chest cavity. Similar decelerometer readings were taken simultaneously from the car frame.

Since the most important action in these test collisions takes place in less than a half a second and all of the movement occurs in less than three seconds, some means of accurately recording the proceedings was necessary for a later study. Therefore, a series of high and normal speed cameras was placed approximately as shown on the typical test site layout diagram, Figure 2, and used to record the tests covering all movements of the vehicle, the dummy, and the barrier during the collisions for this analysis.

The information on film, the strip chart recordings of the decelerations developed by "Sierra Sam" (the anthropometric dummy) and supplementary recordings of various dynamic strains by the use of SR4 gages located on some of the barrier systems made up the bulk of dynamic data collected during this study. In addition to this information, all physical changes in dimensions and conditions of the barrier systems were recorded by trained observers at the site along with observations and appraisals of damage to the car during and after collision.

Best Barrier Described

Of the 15 median barrier designs tested, only one satisfied all criteria as an overall efficient barrier when subjected to high-speed collision. The combination cable-chain link barrier, Figure 4, (1) acted as a positive barrier; (2) minimized the possibility of rear-end accidents by retaining the vehicle within the median strip, and (3) slowed the vehicle gradually, thereby minimizing the probability of serious injury to occupants of the car.

The second most successful design for a median barrier is the blocked out metal beam barrier shown by the test data sheet, Figure 5. This barrier answered all three criteria to some degree: (1) it did act as a positive barrier; (2) while it did reflect the offending vehicle back into the traffic stream, the speed and angle usually was such that following traffic would have some opportunity for evasive action; and (3) it resulted in decelerations of the offending car during collision which while high would be within the possible limits of human tolerance, so there is some probability of surviving a high-speed collision with this barrier.

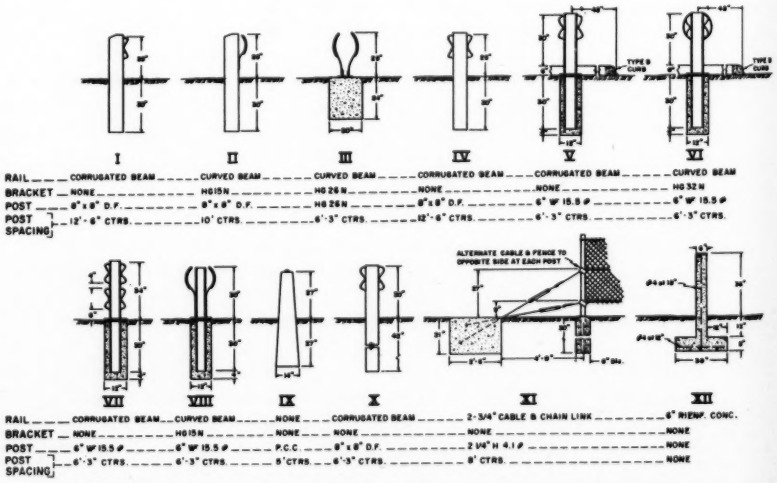
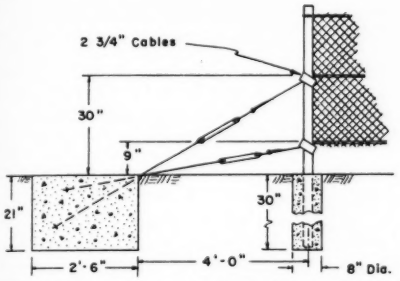

I
II
III
IV
V
VI
RAIL — CORRUGATED BEAM — CURVED BEAM — CURVED BEAM — CORRUGATED BEAM — CORRUGATED BEAM — CURVED BEAM
BRACKET — NONE — HG15N — HG 26 N — NONE — NONE — HG 32 N
POST — 8" x 8" D.F. — 8" x 8" D.F. — HG 26 N — 8" x 8" D.F. — 6" W 15.5 # — 6" W 15.5 #
POST SPACING — 12'-6" CTRS. — 10' CTRS. — 6'-3" CTRS. — 12'-6" CTRS. — 6'-3" CTRS. — 6'-3" CTRS.
TYPE B CURB
VII
VIII
IX
X
XI
XII
ALTERNATE CABLE & FENCE TO OPPOSITE SIDE AT EACH POST
RAIL — CORRUGATED BEAM — CURVED BEAM — NONE — CORRUGATED BEAM — 2-3/4" CABLE & CHAIN LINK — 6" REINF. CONC.
BRACKET — NONE — HG15N — NONE — NONE — NONE — NONE
POST — 6" W 15.5 # — 6" W 15.5 # — P.C.C. — 8" x 8" D.F. — 2 1/4" H 4.1 # — NONE
POST SPACING — 6'-3" CTRS. — 6'-3" CTRS. — 5' CTRS. — 6'-3" CTRS. — 8' CTRS. — NONE

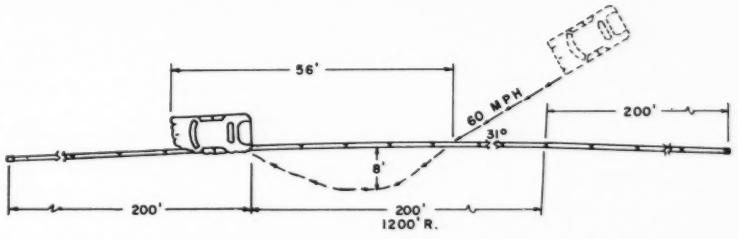
Figure 3
Preliminary tests were made on 15 barrier designs. Twelve of these are shown above. Two others, which proved the most efficient, are illustrated in Figures 4 and 5. The other design was a modification of Type IV above.

POST IMPACT

IMPACT + 750 M SEC.

IMPACT + 225 M SEC.





GUARDRAIL ..... 36" Chain Link Fence w/2 3/4" cables 9" & 30" above pvmt.	DUMMY INJURY ..... Scalp laceration, possible chest injuries.	TEST NO. 21
POST ..... 2 1/4" - 4.1 # H Section Fence Post.	GUARDRAIL DAMAGE ..... 56' of fence knocked out. No damage to cables.	DATE 3-20-59
POST SPACING ..... 8' O.C.	POST DAMAGE ..... 12 posts damaged beyond repair.	VEHICLE ..... Chev. 53 Sedan
LENGTH OF INSTALLATION... 600'	VEHICLE DAMAGE ..... Total loss.	SPEED ..... 60 MPH
GROUND CONDITION ..... Wet	MAX. DYNAMIC DEFLECTION OF RAIL ... 8'	IMPACT ANGLE ... 31°
	VEHICLE DECELERATION (PEAK) ... Long. NG ...Transv. NG	VEHICLE WEIGHT... 3850 (W/DUMMY & INSTRUMENTATION)
	DUMMY DECELERATION (PEAK) ..... Long. 6G ...Transv. 4G	

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Figure 4

In order to determine the effect of a curve, a collision test was made on the outside of a barrier with a 1,200-foot radius, as shown above. The curvature had no effect on the overall results.

For center strips where neither of the above two barriers are suitable, such as in areas where not enough space exists for the blocked out metal beam barrier or in places where earth foundation material is not available such as on a concrete structure, a concrete wall type barrier could be used. The concrete wall type design shown by barrier Number XII on Figure 3 proved to be too light by test. An adequate design would need to be slightly stronger than this tested design.

Concrete Barriers Tested

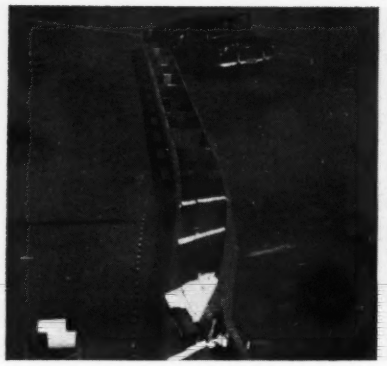
Successful tests on concrete wall barriers proposed as bridge railings show that when subjected to severe collisions this type of barrier will satisfy the first two criteria for a successful barrier but probably will not be a success in the third category. In other words, such railings can definitely be constructed to act as a positive barrier, will reflect the offending car back into its traffic stream, and the reflection angle will be such that the following traffic will have some opportunity for evasive action. However, the speed of the car caroming off the barrier will be so rapid that closely following vehicles will have little time for evasive action. Unfortunately, a concrete barrier produces much higher decelerations due to the change in direction during collision than either the cable-chain link or metal beam barriers and therefore the chance of survival during violent collisions appears to be minimized.

A departmental report has been prepared describing and analyzing the results of each test conducted during this program, but due to the limitations of an article of this nature, no attempt will be made here to develop this complete detail. The following discussion of this study is therefore limited to pertinent details.

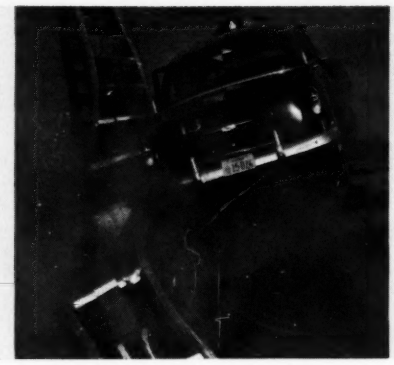
The attention of the reader should first be directed to the fact that because of the cost of such a test program, it is always necessary to hold the number of tests to the very minimum needed to provide a proper guide to engineering judgment, rather than to attempt to perform sufficient testing to develop the absolute parameters of all details. It should also be pointed out that the results of this test program were tempered not only by the actual operating experience of the Division of Highways with several current designs of median barriers but also by a series of dynamic tests on various barrier curbing and bridge rails performed during the years of 1953, 1954, and 1955. This background will now be further supplemented by operating data of several trial installations of the two designs recommended by this sudy.

Barrier Types Listed

This study as well as research into studies by others led us to feel that

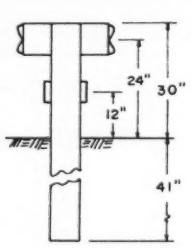


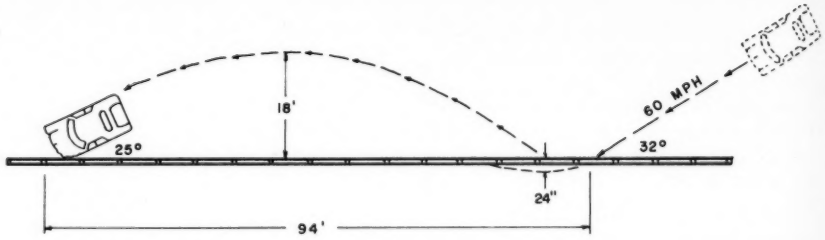
POST IMPACT



IMPACT + 500 M SEC.

IMPACT + 100 M SEC.





GUARDRAIL	W Section	DUMMY INJURY	Possible left shoulder, arm & side injuries.	TEST NO.	13
CHANNEL	6" ⊓ 8.2 #	GUARDRAIL DAMAGE	4 Sections damaged beyond repair.	DATE	12-18-58
BRACKET	8x8x12 D.F Block	CHANNEL DAMAGE	4 Sections damaged beyond repair.	VEHICLE	Chev. 53 Sedan
POST	8x8 D.F.	POST DAMAGE	3 Posts damaged beyond repair.	SPEED	60 MPH
POST SPACING	6'-3" O.C.			IMPACT ANGLE	32°
LENGTH OF INSTALLATION	125'	VEHICLE DAMAGE	$ 900	VEHICLE WEIGHT	4000
GROUND CONDITION	Dry	MAX. DYNAMIC DEFLECTION OF RAIL	37"	(W/DUMMY & INSTRUMENTATION)	
		VEHICLE DECELERATION (PEAK)	Long. 10.4 G ... Transv. 19.8 G		
		DUMMY DECELERATION (PEAK)	Long. 16 G ... Transv. 18 G		

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Figure 5
Tests on a semi-rigid barrier of timber posts in an earth foundation are shown above.

barriers should be grouped in three broad classifications. These are the: (1) flexible type; (2) semirigid type; and (3) rigid. The criteria used in this study for a flexible type of barrier was a design which would fulfill the barrier concept while at the same time it would flex and deform under collision such that deceleration of the offending car would be tolerable to its occupants and at the same time would provide safe maneuvering time and space for any following cars in its own traffic stream. This being a relatively new concept insofar as median barriers were concerned, no practical working designs could be found, although certain varieties of rosebushes have been reported to function as such with partial success in wide medians in some of the eastern states. During the study period prior to this actual testing program, several different designs were considered by the Median Barrier Committee but were discarded for various reasons. One design, Design XI, Figure 3, was offered by the Landscape Design Section with the idea in mind that the chain link structure would have a double function as it could also be used to grow ivy or other leafy materials on it to serve as a headlight screen.

Six tests were performed on various detail modifications of this original design until the details shown on Figure 4 were developed. This design appears to be well balanced in that it functioned efficiently both at a low speed, low angle collision and at a high speed, high angle collision with passenger cars and at a high angle and speed bus collision. As noted above, it will support a growth of ivy or other vines to serve as a headlight screen. In areas where growth cannot be obtained, it is suggested that light wooden or metal strips be inserted in the chain link fabric to serve the same purpose. In the latter case it is probable that the chain link fabric should be at least 48 inches wide rather than the 36 inches used in this series of tests. Indications are that this additional foot in height will not seriously affect the operation of the design as a barrier as long as the cable system remains undisturbed.

Lower Cable Serves Purpose

The lower cable has a double purpose of serving to distribute the collision load to the back posts thereby stiffening the system in general while at the same time allowing the colliding wheel to pass over it during initial impact. This also serves as a trap preventing the return of the front wheel, thus helping to retain the car in the center strip. The nine-inch height appears to be about the right elevation for this trapping purpose.

The top cable chord, consisting of two cables, is the most important structural item in this system. Its placement with respect to height is critical, and its attachment to the post is likewise critical. If the cable is placed too low, it will either permit the car to pass on over the system or force the car to bounce back into the traffic stream. If placed too high, the cable might tend to slip over the car hood permitting the car to pass on through, perhaps severing the superstructure.

The final design height of 30 inches above the ground has proven to be approximately the proper height for this top cable. As this cable height is well above the center of gravity of most cars on the road today, there is no tendency for the car to roll over the cable. At the same time insofar as the average passenger car is concerned, the cable will cut into the body sheet metal and slip over the colliding wheel. This action helps to retain the car in the median area throughout the collision, as well as preventing the return of the vehicle to the traffic lanes. As shown by Figure 1, this height is also effective in stopping a bus.

Single Versus Double Cable

The originally suggested design was tested using a single cable rather than the double cable shown in the final design. A load cell on this cable indicated that insofar as peak load is concerned, the single cable would serve. However, to be most effective the cable should be located on the collision side, thus the two cables. In addition the risk involved in kinking or cutting one cable during collision is such that the factor of safety provided by two cables is well worth the slight additional cost. The fittings used to fasten the cable to the posts must be so designed that they will clamp the cable firmly in place, but under collision loading can slip off the end of the posts, acting as a series of friction brakes. When installing this barrier, no attempt should be made to permanently fix the cable to the post. If the cable were fixed securely to the post, this would result in trapping and cartwheeling the car rather than gradually snubbing it to a tolerable deceleration.

The end anchorages do pose a definite problem. An anchorage strong enough to develop the strength of the cable is so strong that a car striking the cable at an anchorage is tripped rather than snubbed to a gentle stop. This tripping tends to cartwheel the colliding car in an uncontrolled manner with the possible unfortunate result that the car could pass on over the barrier, although such did not occur during the test of the anchorage system during this study.

Anchor Should Be Protected

Under operating conditions the anchor should be placed at a point where other fixed objects normally occupy the median area, such as a bridge pier. Insofar as distance between the anchors is concerned, it was determined by tests that each additional 100 feet of spacing would contribute not more than two or three inches of additional side deflection when subjected to collision. The only practical limitation in the length would be that determined by the effect of temperature or the taking up of slack during repair. If an anchor must be placed in an isolated location, then it should be protected with a metal beam barrier. In order to determine the effect of a curve, a collision test was made on the outside of a 1,200-foot radius curve as shown in Figure 4. The curvature had no effect on the overall results.

The cables should be placed and maintained in a snug condition but should not be stretched enough to produce any appreciable initial stress. In order to maintain the cable in this condition, turnbuckles need to be placed about every five hundred feet so as to permit adjustment for average seasonal changes as well as provide reasonable lengths for construction and replacement.

The cable-chain link barrier is estimated to cost slightly less than half as much as the blocked out metal beam barrier. The metal beam design is estimated to cost approximately $11 per lineal foot.

The criterion used in this study for a semirigid type of barrier was a design strong enough to fulfill the barrier concept while at the same time capable of deforming into a smooth curve without "pocketing" under collision. A change of direction of the colliding car would not be as abrupt as if the barrier were as completely rigid as a concrete wall. The semirigid barrier should provide some opportunity to the occupants of the offending car to survive and at the same time permit a reflection of the car at an angle flat enough to allow following cars an opportunity for evasive action.

Nine Designs Selected

During the study period prior to actual testing, nine different designs were selected by the Median Barrier Committee for testing. These are Designs I, II, III, IV, V, VI, VII, VIII, and X on Figure 3. The results of tests of these installations led to the barrier shown on test sheet Figure 5.

General findings of the tests on the first nine designs were that the semirigid barrier height has to be above the center of gravity of the vehicle and permit the front of the impacting vehicle to bind or be entrapped under the top rail. This action tends to brake the car, hold the rail at its original elevation, and reduce the tendency for the car to roll laterally with the barrier when the posts of the system are forced back and down. If such provisions are not made, then a tendency to roll is imparted to the car as is illustrated by Figure 6. Unfortunately, it was also found that when a rail is placed high enough for the car frame and wheel to get under it, it is necessary to protect the posts of the barrier system from direct collision with the vehicle, otherwise the car frame impacts the post and is subjected to excessive decelerations such as is illustrated by Figure 7.

These two problems were solved first by placing the top rail in a position blocked out from the post at a height so that the car, no matter what the angle of collision, would have just sufficient space to force under the rail. The posts exposed below the top rail were protected by a lower rail so as to prevent the car from direct collision with the posts. Test results also indicated that steel posts mounted in concrete were too rigid for this type of barrier, that a balanced design indicated better success with the system if the more resilient action of Douglas fir timber posts in earth foundation were employed. This latter combination created a barrier system which had a good dynamic reaction within the classification of semirigidity. The overall results are shown on the test data sheet, Figure 5.

Rigid Barriers Considered

For the purposes of this study a rigid barrier was considered to be a structure that would neither fail nor measurably deflect under collision loading. During this study only one design, Design XII on Figure 3, was constructed specifically as a median barrier. However, this particular de-

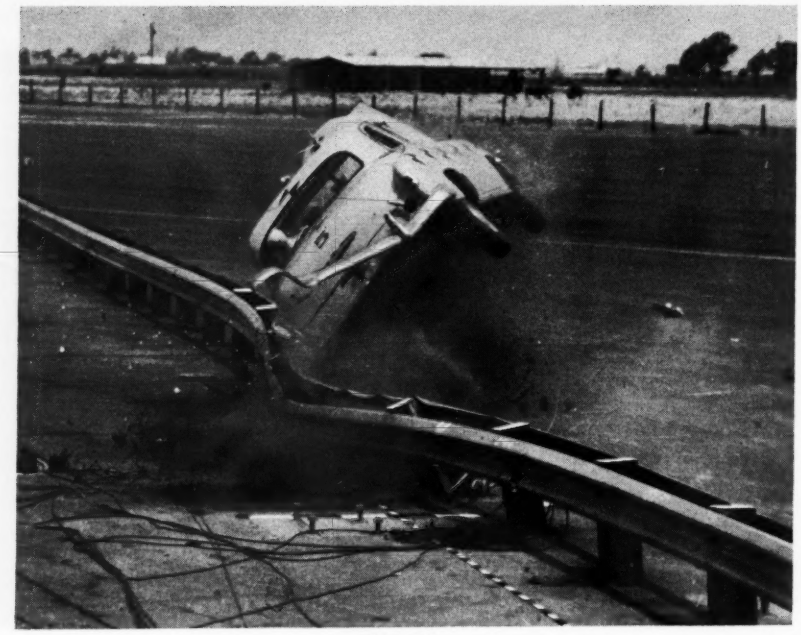


Figure 6
Tests showed that the height of a semi-rigid barrier must be above the center of gravity of the vehicle; otherwise, a tendency to roll is imparted to the car, as shown here.

sign was supplemented by information gained by dynamic tests of five concrete bridge rails performed and reported in 1955 and two such rails tested during this program. The barrier utilized for the current series was extremely light and failed during the test. However, its results coupled with the other information already referred to indicate that a successful concrete median barrier could be developed to cost about $11 per lineal foot.

One other type of concrete median barrier was tested during this study. It is shown as Design IX on Figure 3 and consists of a series of truncated cone concrete posts placed at five-foot centers. This design was not effective as a positive barrier and so should be considered only as a deterring type of median barrier.

During this series of tests only one curb height was tested. This was the typical six-inch high Type B curb employed around many California highway median areas. However, the findings from these two tests are supplemented by some 200 previous full-scale tests performed on highway bridge curbing and so are sufficient to support firm conclusions as to the effect of curbings in front of a median barrier. At high speeds the six-inch high type of curb seems to have little or no effect on either the rise or deflection of the collision car. This is explained by the fact that wheels and springs of a car are deflected over the six-inch high curb with little appreciable change in elevation of the car itself. In other words, both the center of gravity of the car and the frame of the car maintain their traveling elevation while the raise of the curb is taken up in the deflection of the tire and the springing system of the car. This effect is only true where the travel time between the curb and the barrier is very short in that the car soon recovers its original relative elevation to the ground and due to rebound is for a short time elevated above normal. Previous studies show that where the curb is eight inches or higher, an immediate "dynamic jump" is imparted to the car. Therefore barriers behind such curbs must contain a provision to contain the dynamic rise.

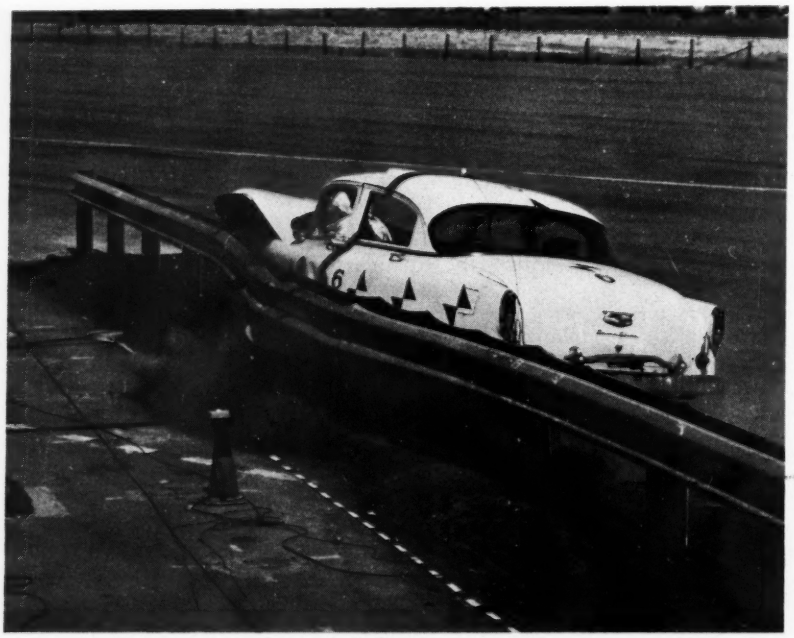


Figure 7
Tests also revealed that if a rail is placed too high, the car frame and wheel may get under it and strike the post, decelerating the vehicle too rapidly, as shown here.

Standard 4-door Sedans Used

Excluding one 34-passenger 17,000-pound bus, the vehicles employed in this 1959 test series were standard 4-door sedans weighing about 4,000 pounds with dummy and instrumentation. The center of gravity of these vehicles was between 21 and 23 inches above the pavement. In converting these cars for radio remote operation, the rear seat, spare tire, and gas tank were removed and the following equipment was installed.

1. The radio control equipment for remote driving the cars was securely bolted down in the trunk compartment. Whip antennae were mounted on the rear of the vehicle.

2. A small walkie-talkie transmitter mounted adjacent to the radio control receiver rebroadcast the command signals back to the control operator following behind the crash vehicle. This feedback of signals was essential in providing the control operator audio contact with the crash car to insure

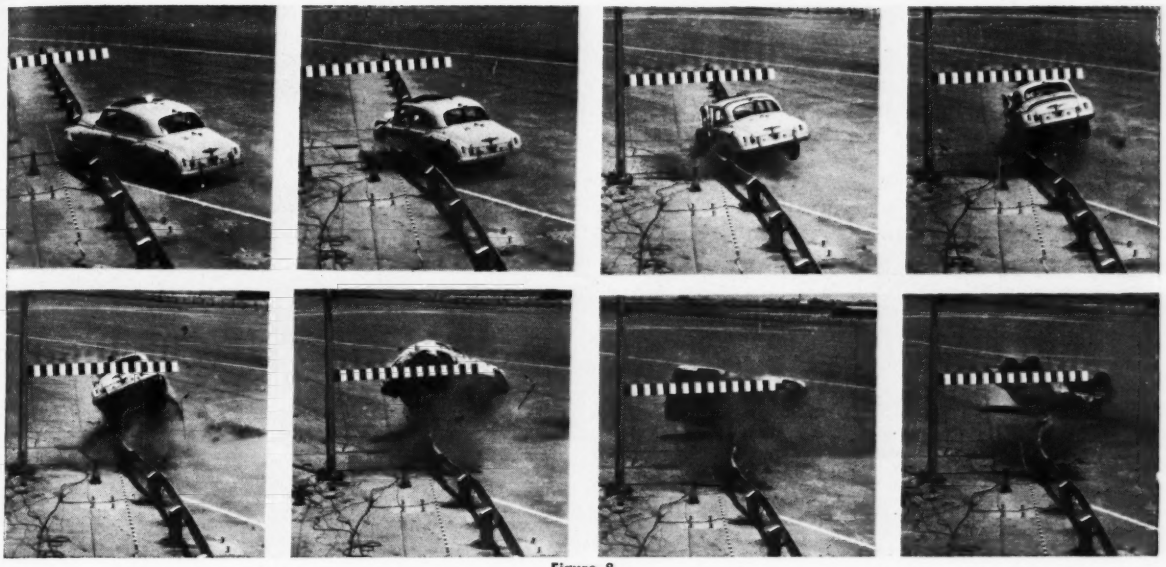


Figure 8
These photos illustrate the film strips used for test analysis. The series shows progressive positions of the test car from the first collision in the upper left corner to rest in the lower right.

that command signals were properly received and executed before the actual response of the vehicle was visible.

3. The 12-volt D.C. steering motor was attached to a mounting plate welded to the front floorboard. The motor was belt connected to an adjustable sheave on the steering wheel.

4. A motor actuated Bendix hydrovac booster was attached to the master brake cylinder.

5. The ignition system was bypassed and wired into the radio control receiver.

6. A one-gallon heavy wall gas tank was installed over the spare tire well. Safety vent and supply valves were employed to prevent fuel spillage or damage in case of fire.

7. Accelerometers mounted in the dummy and on the crash vehicle frame transmitted deceleration data to recording equipment through a coiled 300-foot tether line connected between the crash vehicle and a close following instrument truck.

8. Two 12-volt storage batteries mounted on the rear floorboards furnished power to all control instruments and the radio equipment.

The radio control transmitter was mounted in the bed of the control truck. A special steering switch and brake switch on the dashboard of this pilot car transmitted three specific modulated tones. These tones were received through a selective relay system in the radio control receiver to steer or brake the crash test car. In case of emergency shutting off the transmitter or applying the brakes would kill the ignition in the crash car.

The crash car was placed in operation by clamping the throttle full open, placing the car in high gear, turning on the radio control transmitter which would activate the ignition, and pushing the car with a truck until the engine started and took hold. A peak speed of 58 to 62 m.p.h. on the 2,000 ± foot collision path was attained.

Camera Produces Sequence

The 70 mm. sequence camera was used to produce a documentary series which could be enlarged to examine details of the impact. The bulk of the photographs reproduced in this article were made with this camera which has proven itself a valuable tool. A sequence is illustrated by the series of stopped action photographs of one test shown by Figure 8.

During the two bus crashes an additional 200 f.p.s. camera was mounted in the bus to record the kinematics of the anthropometric dummy.

Pressure sensitive micro switches mounted in the path of the crash car were used to trip flashbulbs located behind the barrier in view of the tower camera. These flashbulbs permitted accurate evaluation of the vehicle approach velocities by noting these flashes on the film of the 1,200 f.p.s. overhead camera. This particular camera also recorded 1,000-cycle timing pips on the film which permits accurate timing of the sequences as well as crash car velocities.

A third flashbulb mounted on the crash car was set to fire at a 2 "G" deceleration level. A pulse from this flash placed a pip on the accelerometer oscillograph base line, which permitted correlation of the oscillograph impact records with the reactions observed in the various data film.

A segmented drum revolving at 1,600 r.p.m. in view of the cameras provided a time interlock between all cameras.

Stresses Correlated

On those occasions when strain gage readings were made of the various guard rails, the individual timing pips were taken from the flashbulb circuits and placed on these oscillograph recordings in order to correlate the various stresses with the position of the crash car.

Altogether the operation of various cameras and the means of sequencing these units with the various instruments may appear complicated. In effect the system was relatively simple as all equipment was operated from a central control board. The care taken in interrelating the timing of sequences during the various crashes has paid off in correlating details while working up the final studies.

The actions and reactions of the anthropometric dummy during the crashes have been found to be exceedingly complex. In a number of the initial crashes a portion of the car roof was removed over the driver's seat in order to permit high speed photographic study of his gyrations. In gen-

(Continued on page 42)

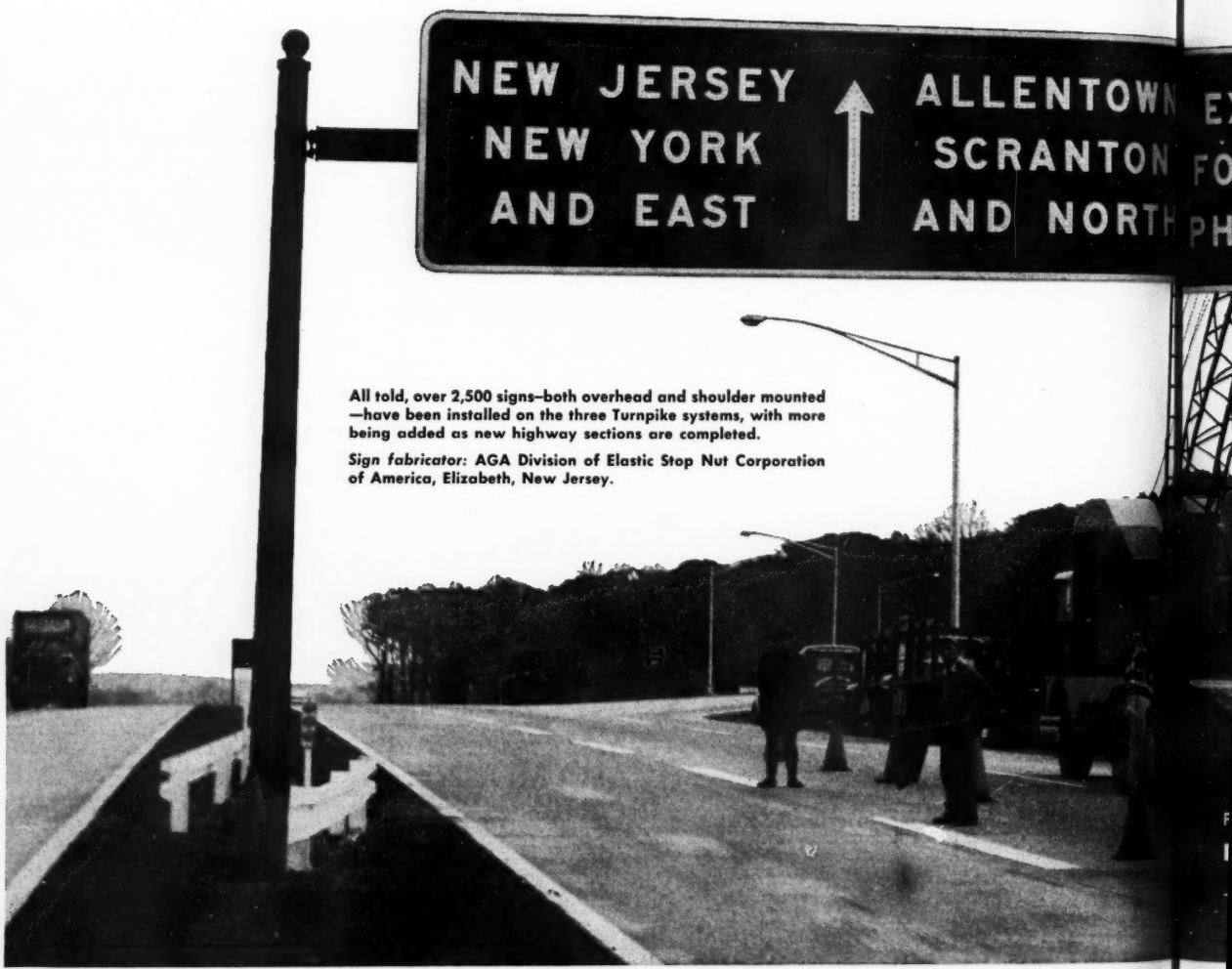
New Jersey Turnpike
New York State Thruway
Pennsylvania Turnpike

Overlaid plywood h on the new e

KING SIZE OVERLAID PLYWOOD SIGNS take the guesswork out of motoring along the new controlled access highways that speed traffic to and from the busy Eastern metropolitan areas.

Strategically located and reflectorized for nighttime legibility, these bright, easy-to-read signs make the New York Thruway and Pennsylvania and New Jersey Turnpikes a prime example of efficient highway signing. And because they cost less than signs of other materials—both initially and in long-term maintenance—overlaid plywood helps do this better signing job for less money.

Signs of overlaid plywood stand up better under severe weathering, deliberate or accidental abuse. Plywood's strength and stiffness simplifies framing. Standard panels can be easily cut or combined to make signs of any size or design. The durable plastic-like overlay prevents checking, provides an ideal base for paint or reflectorizing.



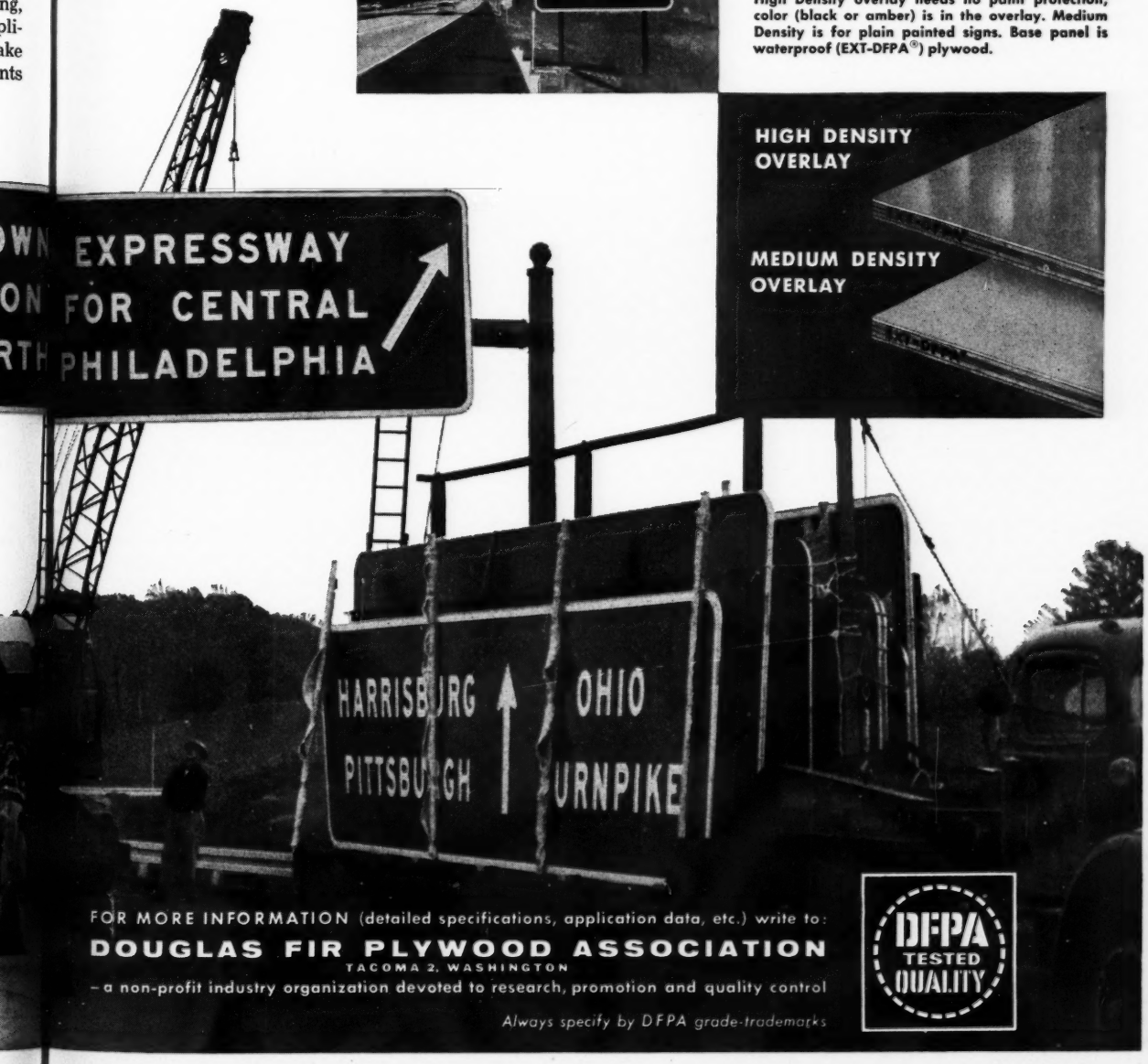
All told, over 2,500 signs—both overhead and shoulder mounted —have been installed on the three Turnpike systems, with more being added as new highway sections are completed.

Sign fabricator: **AGA Division of Elastic Stop Nut Corporation of America, Elizabeth, New Jersey.**

d helps cut signing costs w eastern turnpike systems

Overlaid plywood sign panels are stronger, more durable than metal. On shoulder mounted signs, fir plywood's greater stiffness means backing or supporting framework can be eliminated.

Durable overlay eliminates checking, grain raise. High Density overlay needs no paint protection; color (black or amber) is in the overlay. Medium Density is for plain painted signs. Base panel is waterproof (EXT-DFPA®) plywood.



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Traffic News

Program for Urban Transportation Proposed By National Committee

The National Committee on Urban Transportation, at a recent meeting in Washington, D. C., proposed an operating program for 1960, subject to the development of financial support. The purposes and objectives of the Committee's continuing six-point program are:

1. To encourage urban transportation planning through:
(a) Demonstration Projects
(b) Short courses and seminars for public officials
(c) Speakers and information at meetings of public officials
(d) Continuing field contacts
2. To review and evaluate the procedures developed as applied in demonstration projects and other transportation planning programs;
3. To modify, refine and simplify procedures as study experience may indicate;
4. Upon request, provide technical assistance to local and state governments in organizing and carrying out transportation study and planning programs;
5. To collect, analyze and prepare for publication significant data developed in demonstration projects and other transportation planning programs;
6. To complete and prepare for publication two additional procedure manuals authorized by the National Committee, *Developing the Transportation Plan* and *Financing the Transportation Program*. Although development of these manuals is now under way, their completion and publication will not be accomplished until some time during 1960. Two other manuals, *Cost Accounting* and *Project Priorities* will be ready for publication in late 1959.

Several cities are now being considered as possible demonstration projects to illustrate the advantages of the Committee's program and cooperative transportation planning. It is anticipated that several such projects will be organized by the end of the year.

Automotive Safety Foundation Elects E. J. Thomas

E. J. Thomas, Chairman of the Board, Goodyear Tire & Rubber Company, was elected Vice Chairman of the Automotive Safety Foundation at its annual meeting. He succeeds L. R. Jackson, Vice Chairman, Firestone Tire & Rubber Company.

Stanley Hope, Foundation Chairman, announced that three new members of its Operating Committee also were elected. They are H. E. Humphreys, Jr., Chairman of the Board, United States Rubber Company; J. Ed. Warren, President, Cities Service Company, and Herbert Willetts, President, Mobil Oil Company.

New members of the Board of Trustees elected include:

Warren A. Birt, Sr., President, National Wheel and Rim Association; Earl B. Hathaway, Vice President, Firestone Tire & Rubber Company, and Robert E. MacNeal, President, Curtis Publishing Company.

Other Vice Chairmen of the Foundation are:

Henry T. Bodman, President, National Bank of Detroit; Malcolm P. Ferguson, President, Bendix Aviation Corporation; E. L. Grimes, Chairman of the Board, Commercial Credit Company; Clifford F. Hood, former President, United States Steel Corporation; John E. Swearingen, President, Standard Oil Company (Indiana); William F. Hufstader, Vice President, General Motors Corporation; G. Donald Kennedy, President, Portland Cement Association, and Warner S. Shelly, President, N. W. Ayer & Sons.

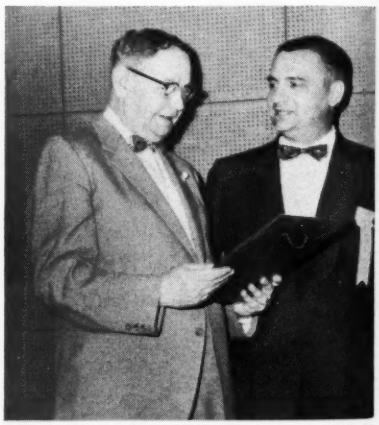
Marsh Presented With Hoffman Award

The third annual Paul Gray Hoffman Award for outstanding professional services in highway safety was conferred on Burton W. Marsh, of Washington, D. C., Director of the traffic engineering and safety department, American Automobile Association.

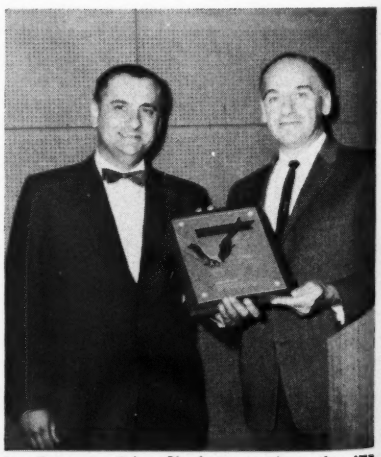
The presentation was made at ceremonies concluding the annual meeting of Trustees of the Automotive Safety Foundation (Plaza Hotel) by the donor, Paul G. Hoffman, Managing Director of the United Nations Special Fund, who is a former president and chairman of the Foundation and a pioneer leader of the traffic safety movement.

Mr. Marsh was honored for distinguished national service over many years to traffic engineering, high school driver education, school safety patrols and pedestrian safety.

One of the country's first traffic engineers, (Pittsburgh, 1925) he is past chairman of the Highway Research Board's executive committee, vice chairman of the National Committee on Uniform Laws and Ordinances, and past chairman of the National Committee for Traffic Training.



ITE Award to City of Seattle is presented to David Levine, President of the Seattle City Council by Matthew C. Sielski.



Lt. Governor John Cherburg receives the ITE Award to the State of Washington from Matthew C. Sielski.

Jaycees Form Advisory Council

Wide-spread support from professional groups involved in community planning and development—including the Institute of Traffic Engineers—has given new impetus to the U. S. Junior Chamber of Commerce's grass roots program for community betterment.

The program, co-sponsored by American Motors Corporation, encourages Jaycees to effectually survey their communities for major local needs, then conduct action projects to solve them.

Early in their 1958-59 program the Jaycees recognized the need for a professional element, and brought together representatives from nine professional and semi-professional organizations to serve as an advisory group.

Called the Professional Advisory Council on Community Development, it was formed May 25, in Detroit, and includes representatives from ITE, American Institute of Planners, American Society of Civil Engineers, American Society of Planning Officials, American Society of Landscape Architects, Consulting Engineers Council, Association of State Planning and Development Agencies, American Institute of Architects, and the American Planning and Civic Association.

Alger Malo of Detroit, Michigan, is the ITE representative. Purposes adopted by PACCD are:

1. To advise the U. S. Jaycees on the formulation and execution of a sound civic planning and development program.

2. To encourage activities that will enhance the prestige and public understanding of the role of community planning and development.

"The formation of this council should make the Jaycee Community Development Program much more effective," President Bob Clark of the U. S. Jaycees said recently. "We have 2,000,000 members in 3,700 American communities. Last year, more than 2,000 communities benefited from Jaycee community development work. With the addition of this source of professional advice, more Jaycees will be aiming for higher objectives."

One of the first activities to be initiated by PACCD was the establishment of similar councils on the regional, state, and local levels of Jaycee activity.

Under the leadership of Charles A. Blessing of Detroit, AIP president and PACCD chairman, the first such council was formed August 31, to advise Oklahoma Jaycees. Later, other councils were formed for Missouri and Illinois. Minnesota and Wisconsin are in the process.

The procedure for forming the councils was approved by PACCD at a recent meeting in St. Louis:

1. The local or state Jaycee organization must first inform the national office in Tulsa that a council is desired.

2. John Martin Meek, manager of the U. S. Jaycee Community Development Department, then either (a) requests the presidents of the state or regional professional societies to name a member to the council or (b) makes the same request of the societies' national offices, if there are no smaller units.

Once the councils are formed, members plan their programs, objectives and activities to meet needs within their respective areas.

The regional councils are only a part of PACCD's planned activities. Others include establishing a graduate fellowship in city planning, suggesting areas for original research, assisting in acquiring funds to publish special studies or manuscripts, and exploring the need for a non-technical quarterly publication devoted to activities in the planning field.

Less than six months old, PACCD has accomplished part of its objectives. The first fellowship winner, Donald Gerhard, former member of the Minneapolis Planning Commission, is studying this year at the University of Wisconsin under a $2,800 financial grant from American Motors. A $1,000 cost-of-education grant also was given to the university by the motor company.

A possible research project is being investigated by a special PAACD committee, and a substantial grant to finance the work is expected to be made by American Motors in the near future.

Much of the Jaycee program's growth on the national scale is the result of the co-sponsorship with American Motors, beginning October, 1958.

Explaining American Motors' interest in community improvement work, President George Romney, widely known civic and church leader, recently set forth these reasons:

1. Because the automobile has helped create some of the problems communities face, it is the motor industry's responsibility to help formulate sound policies and support activities that will aid in their solution.

2. His company believes the future of the country, and the world, depends on the development of a new and higher expression of citizenship in America.

Coming Events

January 11-15—HIGHWAY RESEARCH BOARD—
Sheraton-Park Hotel, Washington, D. C. Contact: Highway Research Board, 2101 Constitution Ave., Washington 25, D.C.

SPECIAL NOTICE

The Washington Section, ITE announces that their January meeting will be held Wednesday, January 13, at the Broadmoor, 3610 Connecticut Ave., Washington, D.C., with a social hour starting at 5:15 and dinner at 6:15, followed by a well-known speaker. The meeting will adjourn early enough to enable attendance at evening committee meetings. All Institute members and their friends are invited. Tickets will be available at the Sheraton-Park on Monday and Tuesday.

January 11-15 — SOCIETY OF AUTOMOTIVE ENGINEERS
Annual Meeting, Sheraton - Cadillac & Statler Hotels, Detroit, Mich. Contact: SAE, 485 Lexington Ave., N. Y. 17, N. Y.

February 18-20—NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS—
Winter Meeting, Broadview Hotel, Wichita, Kan. Contact: Kenneth E. Trombley, NSPE, 2029 K Street, NW, Washington 6, D.C.

March 6-8—SOUTHERN SAFETY CONFERENCE—
Jacksonville, Florida. Contact: W. L. Groth, P.O. Box 8927, Richmond, Va.

March 23-25 — NORTHWEST HIGHWAY ENGINEERING CONFERENCE—
Oregon State College campus, Salem, Oregon. A combination of the former Northwest Traffic Engineering Conference and the Northwest Road Building Conference. Contact: J. Al. Head, Assistant Traffic Engineer, Oregon State Highway Department, Salem, Ore.

May 10-12 — NATIONAL HIGHWAY USERS CONFERENCE—
Eighth Highway Transportation Congress, Mayflower Hotel, Washington, D.C. Contact: Arthur C. Butler, NHUC, National Press Building, Washington 4, D.C.

June 8-11—NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS—
Annual Meeting, Statler Hotel, Boston, Mass. Contact: Kenneth E. Trombley, NSPE, 2029 K Street, NW, Washington 6, D.C.

September 12-16—INSTITUTE OF TRAFFIC ENGINEERS—
30th Annual Meeting, Edgewater Beach Hotel, Chicago, Ill. Contact: ITE, 2029 K St. N.W., Washington 6, D. C.

(Continued on page 48)

New Appointments

Avery Named Chief Engineer

Eugene V. Avery (Assoc. Mem., ITE) has been named Chief Engineer of the Department of Public Works in St. Paul, Minnesota.

Avery has been traffic engineer in St. Paul since 1953. Last March he was named Assistant Chief Engineer, and this change moves him to the top spot in the department.

A graduate of Case, Avery completed the Yale Bureau course in 1953. Before this he had worked in Berkeley and for the Bureau of Public Roads.

Kisseleff Leaves Denver For Harvard Post

Louis G. Kisseleff (Assoc. Mem., ITE) has resigned as Associate Traffic Engineer in Denver to become the traffic engineer with the Department of Legal Medicine at Harvard University.

In this position, Kisseleff will be a member of the team of experts studying causes of traffic accidents, operating on a grant of funds from the U. S. Public Health Service. The traffic engineer will evaluate the role of the roadway situation in fatal accidents in and around Boston. Others, including doctors, automotive engineers, lawyers, social workers and psychologists, will be looking into other aspects of the accident at the same time.

A graduate of the University of Colorado, Kisseleff has had extensive experience in photogrammetry, has done consulting work, and worked for the Colorado Highway Department before joining the City in 1956. He is a registered engineer in Colorado.

Bennett Appointed to Insurance Institute

Russell I. Brown, president of the Insurance Institute for Highway Safety, has announced the appointment of Richard O. Bennett as secretary-treasurer.

Mr. Bennett comes to the Insurance Institute from Chicago where he was employed by the National Association of Automotive Mutual Insurance Companies, one of the three associations which formed the Insurance Institute. He directed the Automotive Division of the Mutual Association's Accident and Fire Prevention Department. Mr. Bennett assumed his new duties October 1.

Mr. Brown said that, in addition to duties implicit in the position of secretary-treasurer, Mr. Bennett will be in charge of the office and, at least temporarily, will be responsible for the Institute's grant-in-aid program.

The Insurance Institute was established early in 1959 by the three major casualty insurance groups, the Association of Casualty and Surety Companies, the National Association of Independent Insurers, and the National Association of Automotive Mutual Insurance Companies, for the purpose of attacking the highway accident problem on an industry-wide united front. Previously these three associations had been dealing with this problem independently. The three associations represent a total of 532 member insurance companies.

Mr. Bennett has been identified with the traffic safety movement for more than 25 years. Prior to joining the Mutual Association, he was with the National Safety Council where he helped to set up the Annual Inventory of Traffic Safety Activities. During World War II he served as an officer in the Army Transportation Corps. Prior to that he was director of safety and personnel for Great Lakes Greyhound Lines, Inc., in Detroit.

At present Mr. Bennett is chairman of the National Committee for Motor Fleet Supervisor Training, which conducts approximately 50 training courses in nearly as many colleges and universities throughout the nation. He is a member of the administrative committee for the National Committee on Uniform Traffic Laws and Ordinances and is the immediate past general chairman of the Greater Chicago Chapter of the American Society of Safety Engineers. He is a member of several professional societies and is active in the programs of many national safety organizations.

Insurance Institute Names Koert

Adrian H. Koert, city traffic engineer of Des Moines, Iowa, has been named to the staff of the Insurance Institute for Highway Safety by Russell I. Brown, president. Koert, with 12 years experience in traffic engineering, will specialize in that area for the insurance safety organization.

A native of Grand Rapids, Mich., Koert served more than two years as city traffic engineer of Des Moines. Prior to that he was a traffic engineering consultant with George W. Barton & Associates, Evanston, Ill.

As the first professional traffic engineer of Des Moines, Koert was responsible for the following major accomplishments during his tenure:

1. Imposition of rush-hour parking prohibitions over a 40-block area of the downtown section, resulting in an increase in average speeds from six to 12 miles per hour.

2. Preparation of a parking plan for the East Side Business District which resulted in the expenditure of $300,000 for the acquisition of off-street parking areas and installation of 450 parking meters at the curb.

3. Upgrading of the city's traffic signal system which, among other things, eventually will permit continuous movement on arterial streets at regulated speeds and reduce traffic accidents and congestion.

4. Development of a school-crossing protection program.

5. Review and subsequent improvement of the downtown one-way traffic system.

Koert attended Calvin College in Grand Rapids and earned a B.S. degree in meteorology from New York University in 1944 and a B.S. degree the University of Michigan in 1947. transportation engineering from the

He served in the Air Force during

World War II and held the rank of first lieutenant when released from active duty. Koert is a member of the Institute of Traffic Engineers and the Western Society of Engineers.

Wickstrom Joins Penn-Jersey Study Staff

George V. Wickstrom (Assoc. Mem., ITE) has been appointed Supervising Traffic Engineer for the Penn-Jersey Transportation Study. This is a two-and-a-half million dollar study of transportation in and around the Philadelphia Metropolitan Area.

Wickstrom was Senior Traffic Engineer with Edwards and Kelcey from March of 1958 until accepting this new job. Earlier he had spent five years with the New York City Department of Traffic in charge of the Arterial Planning Division.

A graduate of Cooper Union in civil engineering, he attended the Yale Bureau of Highway Traffic during 1955-1956.

Title Changes

Eugene V. Avery—is now Chief Engineer with the Department of Public Works in St. Paul, Minnesota—was Assistant Chief Engineer.

Ellis C. Henry, Jr. — is now Traffic Commissioner of the City of St. Louis, Mo. — was Assistant Traffic Commissioner and Acting Commissioner.

Robert S. Holmes — is now Assistant Manager of Highway Construction Marketing with the U. S. Steel Corp. —was Highway Construction Representative.

Ralph G. Lewis, Jr. — is now Traffic Engineer with the City of Chattanooga, Tennessee — was Assistant Traffic Engineer.

Donald W. Loutzenheiser — is now Chief, Urban Highway Division with the U. S. Bureau of Public Roads—was Chief, Highway Design Division.

Dee W. McKenzie — is now Senior Civil Engineer i/c of Design for the County of Sacramento, California—was Highway Engineer.

George A. Pecht—is now Highway Engineer with Ammann & Whitney in New York City—was Coordinator-Civil & Structural Engineer.

John C. Tsiknas — is now Associate Traffic Engineer with the City of San Diego, California—was Assistant Traffic Engineer.

William R. Welty—is now Supervising Traffic Engineer with the Texas Highway Department—was Senior Traffic Engineer.

Job Changes

Herman Batts—formerly Traffic Engineer with the City of Ft. Lauderdale, Florida; is now City Traffic Engineer in Des Moines, Iowa.

Jack W. Chambliss — formerly Asst. Traffic Control & Safety Engineer with the Mississippi State Highway Department; is now Traffic Engineer for the City of Montgomery, Ala.

James D. Decker—formerly Associate Traffic Engineer with the Virginia Department of Highways; is now Highway Research Engineer for the Virginia Council of Highway Investigation & Research in Charlottesville, Virginia.

Jerry P. Gilbert—formerly Traffic Engineer with the City Engineering Department of Jackson, Michigan; is now City Traffic Engineer in Springfield, Illinois.

Joseph W. Guyton — formerly with the Corps of Engineers in the U. S. Army; is now Traffic Engineer for Harland Bartholomew & Associates in St. Louis, Mo.

Louis G. Kisseleff—formerly Associate Traffic Engineer with the City of Denver, Colorado; is now Traffic Engineer for the Department of Legal Medicine, Harvard Medical School in Boston, Mass.

George T. March—formerly Traffic Engineer II with the Bureau of Street Traffic in Chicago, Illinois; is now Traffic Engineer for National Advertising Company, 6850 S. Harlem Avenue, Bedford Park, Illinois.

James E. Reading — formerly City Traffic Engineer in San Diego, California; is now Traffic Safety Coordinator for the Intergovernmental Traffic Safety Committee in the same city.

Donald A. Strombom — formerly Assistant Highway Engineer in the Planning Division of the Washington State Highway Department; is now Planning & Traffic Engineer with the King County Engineers Office in Seattle, Washington.

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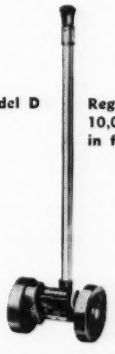

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New Publications

Design of Sharp Horizontal Curves on Roads and Streets with Regard to Vehicle Movements

By Lars-Olof Alm. Kungl. Tekniska Högskolan, Stockholm 70, Sweden. 1959. (With an English summary.)

The author, in recognition of the fact that simple circular curves do not agree very well with vehicular paths on sharp turns, proposes a design for the inner pavement edge which is a combination of two clothoids and a circle. Three types are suggested for various traffic situations, and varying slightly from U. S. practice.

Trip Characteristics and Traffic Assignment

Bulletin 224, Highway Research Board, 2101 Constitution Avenue, Washington 25, D.C. September 1959. 135pp. $2.60.

This bulletin contains 13 papers presented either in open sessions or during committee meetings at the 38th Annual Meeting of the Highway Research Board, as follows:

"Trends in Travel to the Central Business District by Residents of the Washington, D. C., Metropolitan Area, 1948 and 1955," by Jacob Silver.

"Continuous Sampling Method of Conducting Origin - Destination Surveys," by Warren B. Lovejoy.

"Report on Analysis of Urban Work Trips," by Howard S. Lapin.

"A Method of Traffic Assignment to an Urban Network," by J. Douglas Carroll, Jr.

"Land Use Projections for Predicting Future Traffic," by John R. Hamburg.

"Home-Interview Surveys and Related Research Activities," by John T. Lynch.

"Traffic Assignment Using an Electronic Computer," by Glenn E. Brokke.

"Use of IBM Port-a-Punch in Origin-Destination Surveys," by M. A. Beebe.

"Novel Traffic Survey Method Utilizes Vehicle Lights," by M. A. Beebe.

"Application of O-D Data in the Baltimore Region," by Alan M. Voorhees and James W. Booth.

"Estimating and Forecasting Travel for Baltimore by Use of a Mathematical Model," by Alan M. Voorhees and Robert Morris.

"Median Strip Mass Transit and Related Traffic Characteristics on Congress Expressway," by Andrew V. Plummer, Leo G. Wilkie and Robert F. Gran.

"Land Use in Traffic Generation," by William R. McGrath.

An Application of Statistical Control Techniques in Determining Above Normal Accident Risk Sections on the Arizona State Highway System

Arizona State Highway Department (in cooperation with the U. S. Bureau of Public Roads), Phoenix, Arizona. August 1959. 12pp.

This pamphlet is a progress report on a statistical approach to the problem of determining highway sections with an accident experience regarded as above normal or expected. The report concludes that the method proposed is practical and reasonably accurate.

Operations Analysis of Traffic Safety

By Fletcher N. Platt, Manager, Traffic Safety and Highway Improvement Department, Ford Motor Company, Dearborn, Michigan. 1959. 28pp.

This paper presents an interesting approach to a study of traffic safety fundamentals. The author makes a number of assumptions, and proceeds through logical analysis and mathematical processes to attempt to suggest methods of predicting traffic situations which produce accidents and evaluating such situations.

Ran-Off-Roadway Accidents—A Special Study of Their Characteristics

National Safety Council, 425 N. Michigan Avenue, Chicago 11, Illinois. July 1959. 13pp. (mimeo) and appendix.

This is a special report of a study of ran-off-roadway accidents, involving a single vehicle, based on information furnished the Council by 21 states and including reports of a minimum of 22,000 accidents. Studied were factors of location, age of driver, hour, road defects, violations, light condition and road surface, and month of occurrence. Numerous cross - classifications were made.

Report of Studies and Analyses of Requirements Pertaining to Entrances to Roadside Commercial Establishments, 1956-57

State Highway Department of Georgia, 2 Capitol Square, Atlanta 3, Georgia. 33pp., plus numerous plates.

This report, which has just become available, discusses the common problem of designing access and egress points for roadside establishments. The study was divided in two parts, one being tests to determine driver behavior at open entrances, and the other to determine entrance design requirements and frontage requirements based on tractor-trailer turning characteristics.

Survey of Out-of-State Passenger Cars —1959

Oregon State Highway Department, Salem, Oregon. October 1959. 19pp.

This study was made to determine the number of out-of-state motorists using Oregon highways in 1959, and the amount of money spent by them in Oregon. Comparative figures are included for the previous year.

Semi-Annual Speed Studies

Arizona Highway Department, Phoenix, Arizona. October 1959. 35pp.

This report presents the results of the semi-annual examination of speeds and speed trends on Arizona highways. It is interesting to note that speeds were up slightly from the study made a year ago but down slightly from the check made last Spring.

NEW PUBLICATIONS OF THE HIGHWAY RESEARCH BOARD

Bulletin 208

Traffic Accident Studies—1958. 83 pp., $1.60.

Traffic Accidents and the Quality of Traffic Flow. Economic Costs of Motor Vehicle Accidents. Statistical Evaluation of Traffic Accident Severity. An Analysis of One-Car Accidents. Predicting Traffic Accidents from Roadway Elements on Urban Extensions of State Highways. Sampling Procedures for Determining Speed Characteristics at Rural Locations: A Progress Report.

Bulletin 212

Characteristics of Vehicle Operators. 37pp. $0.80.

Driver Characteristics and Speed Performance Related to the Facility. An Investigation of the Role of Psychological Factors in Motor Vehicle Accidents. Relationships Between Driving Records, Selected Personality Characteristics, and Biographical Data of Traffic Offenders and Non-Offenders. Age and Fatal Motor Vehicle Accidents. Final Report of Study on the Effect of a Periodic Refreshment Pause on Simulated-Automobile Driving Performance Efficiency.

Special Report 43
Selective Cutting of Roadside Vegetation for Improved Highway Safety, Appearance and Use. 42pp. $1.20.

Roadside Development 1959
56pp. $1.20.

Report of Committee on Roadside Development. Design of Urban Highway Landscaping. Design of Rural Highway Landscaping. Recent Developments in Soil Erosion Control Practices and Materials. Roadside Design to Reduce Traffic Noise. Maintenance of Interstate Highway Roadsides as Affected by Work Operations. Maintenance of Interstate Highway Roadsides as Affected by Highway Design. Aerial Seeding of Highway Slopes. Land Use Treatment Plan as Related to Maintenance. An Anti-Litter Campaign Reduces Maintenance. General Discussion.

Highway Research Correlation Service

Circular 376
Committee on Highway Capacity. "Current Intersection Capacities."

Circular 386
Committee on Urban Volume Characteristics. "An Application of Data Processing Equipment for Traffic Recorder Data."

Circular 391
Committee on Road User Characteristics. "Report of Subcommittee on Research on Lower Case Letters."

Circular 396
Committee on Land Acquisition and Control of Highway Access and Adjacent Areas. Memorandum 113 — August 1959.

Circular 397
Committee on Urban Research. Memorandum 3 — August 1959. "Economic Impact of Highways on Trade and Commerce."

Circular 398
Committee on Urban Research—Memorandum 4—August 1959. "Tennessee Use of Official Map as a Planning Tool." (See also the discussion on the official map in Memorandum 2, describing the recent New York Official Map and Control of Development Legislation.)

These and a listing of other Highway Research Board publications are available from: Highway Research Board, 2101 Constitution Avenue, Washington 25, D. C.

Strictly Business

New Chemical for Highway Safety

New protection against the corrosive action of salt-slush on wintry streets now is possible with the use of an improved formula rust inhibitor developed by Calgon Company, division of Hagan Chemicals & Controls, Inc., Pittsburgh, according to an announcement by the company.

New, improved Banox, an additive for rock salt spread on ice and snow covered streets, reduces salt brine corrosion damage to automobiles, bridges, roadside structures, walkways and street maintenance equipment by 90 to 95 per cent.

The Hagan polyphosphate compound forms a microscopically thin, but tough, film over metallic surfaces it contacts, thus protecting against corrosive salt-slush. The film neutralizes or inhibits the corrosive action of salt brine, whether on painted or unprotected metals. It also is odorless and non-toxic.

According to the announcement, municipal officials have found handling of Banox simple, as it is mixed with rock salt in a one per cent by weight proportion. Mixing can be done as the rock salt is stored or as the salt trucks are loaded. Uniform distribution in mixing is not important as melting snow and traffic continue the mixing process.

The report states that municipal authorities estimate the cost of Banox treatments for city streets at a few cents per capita per year.

Motorists driving on Banox-treated streets also like the "carry-over" strength of the additive — the protection their cars receive over an extended period of time. Salt brine lodged in fender and body joints remains a constant corrosion threat, requiring only a little moisture to trigger the corrosive action. With Banox-treated salt, the protective film continues to inhibit this action.

Banox is available in a colorless or in a colored form. The latter contains a harmless and non-staining coloring agent which gives treated slush a faint green tint, a constant reminder to motorists of the inhibitor's presence.

Ride Simulator Developed by GM

A standard auto body minus wheels and engine goes through lifesize motions of a passenger car rolling along a bumpy road or a smooth highway in General Motors Research Laboratories.

Controlled by a giant analog computer, the unique ride simulator subjects its driver and passenger to bounce, pitch and roll — the ride motions any moving car undergoes.

Such synthetic travels are important to new suspension systems, plus other possible innovations in car ride, performance and handling.

Development of the ride simulator by GM Research men was disclosed by Robert H. Kohr, vehicle dynamics supervisor for GM Research Laboratories Engineering Mechanics Department, speaking before the midwestern simulation council at the GM Technical Center in Washington, D.C.

According to Mr. Kohr, the simulator reduces engineering time and effort in solving many complex suspension problems formerly solved by cut-and-try engineering with prototype cars on proving grounds and public highways.

He said the simulator "will produce to a high degree of fidelity the motions experienced by a real car on a real road" and it already "has demonstrated its ability to reproduce the on-the-road response of real cars."

"The way is now open to obtain preliminary evaluations of systems without recourse to expensive component construction and to study the passenger and seat combination under closely controlled conditions," he declared.

He explained that high speed analog computers now enable engineers to solve equations of ride motion in greater complexity than ever before, and the ride simulator also permits analyses to take into consideration the road, the car and the passenger.

Road waves are recorded on magnetic tape and then "played" into the analog computer as input disturbance to the four wheels of a synthetic car.

The car body in which the driver and passenger "ride" has front and rear and roll servo actuators which

follow the motions determined by the computer. Here, according to Mr. Kohr, is an overall description of how the ride simulator works:

1. A tape recorder provides road wave inputs into the system. The signal on the tape is picked off at two points on two tracks, simulating right and left front and rear wheels of the car. The tape speed is variable and by speeding up the tape, the car being simulated also is "speeded up."

2. An analog computer takes in the signals from the tape recorder and, from these inputs to the car's tires and the suspension characteristics being simulated, determines what car motions will result. The analog computer runs in "real time," which means that the ride responses generated by the computer occur at the same rate as would the equivalent ride responses of a real car on a real road.

3. A motion simulator reproduces the car motions determined by the computer. The simulator includes a portion of a standard car body and is driven by electro-hydraulic servomechanisms whose inputs are output voltages from the analog computer. Two passengers may be accommodated in the motion simulator and the driver may control the speed of the car by pressing the brake or accelerator which sends a signal to a small computer that determines the resulting car speed and which, in turn, sends a speed signal back to the tape recorder.

In effect, the ride simulator is somewhat similar to airplane flight simulators used in pilot training. A pilot sits in an earthbound cockpit and reacts to various simulated flight situations. The GM device differs in that it is used to determine car riding characteristics; not to train drivers.

Fluorescent Colors For Signs

Tenak Velva-Glo, a daylight fluorescent thermoplastic film, which retains color brightness for approximately two years' outdoor exposure, is announced by Radiant Color Co., Oakland, Calif., manufacturers of fluorescent papers and cardboards, inks, paints, and pigments.

The manufacturers recommend Tenak Velva-Glo for safety and identification markers on barricades, among other uses.

In the graphic arts, Tenak Velva-Glo may be used for outdoor signs, cut-out letters and numerals.

Tenak Velva-Glo comes sandwiched between two protective layers of paper, and may be cut to size and shape with power, hand or die cutters, sharp knife, scissors or razor blade. The plastic fluorescent surface may be printed, brushed or screened once the protective paper layer is removed. According to the manufacturer, Tenak adheres to practically all smooth, clean surfaces, including well-painted wood, metal, glass, porcelain enamel.

Tenak Velva-Glo is made in six exceptionally bright colors—fire engine red, orange-yelllow, red-orange, yellow-orange, green and chartreuse. For samples and instructions for use, write Radiant Color Co., 830 Isabella Street, Oakland 7, California.

Spray Gun Cleaner Cuts Paint Removal Time

The continuing job of removing paint from the spray-gun components of stripe-laying machines used on city streets can prove burdensome to any municipal paint shop or traffic department.

In Memphis, Tennessee, employees of the Police Paint Shop formerly spent up to 30 minutes a day cleaning spray gun parts from the striping machines used by the City.

The shop has three striping machines and time spent removing each day's accumulation of heavy paint build-up on spray gun parts really added up. This work was done by hand, laboriously scraping parts clean with a knife or using a solvent and brush to remove the dried paint.

The problem was solved quickly when the Memphis shop began using Klean-Strip Spray Gun Kleaner on striping machine components, it is reported.

K. S. "Ham" Johnson, foreman of the shop, explained the operation: "When the machines come in from a run at the end of the day, we disassemble the spray-gun unit in a few minutes. The nozzle and head of the gun go into a parts basket provided with Klean-Strip Spray Gun Kleaner. The basket is dunked in the can of cleaner and left overnight. In the morning the parts are perfectly clean and the gun is reassembled in a few minutes, ready for use."

Complete information on Klean-Strip Spray Gun Kleaner and its use in cleaning striping machine components may be obtained by writing the Klean-Strip Company, 2340 South Lauderdale, Memphis 6, Tennessee.

Douglas Fir Appoints John M. Hess

Architecural engineer John M. Hess has been named technical director of the Douglas Fir Plywood Association. The appointment was announced by W. E. Difford, DFPA managing Director.

Hess succeeds Nelson S. Perkins, who was DFPA technical director for twenty years before being named special assistant to the managing director this summer.

In his new post, Hess directs a department with five laboratories which employ 90 engineers, chemists, technical writers, wood technologists and quality supervisors. The technical department will spend over $900,000 this year for plywood quality control, product research, and applied research on behalf of DPFA member mills. The department also does building code work and assists industry committees in the development and revision of plywood industry standards.

The department's operations include three quality control laboratories in Tacoma; Eugene, Oregon and Arcata, California. A trained crew of 34 quality supervisors conducts scientific inspection of plywood production at 121 DFPA member mills. This check assures the continued high quality of DFPA grade-trademarked fir plywood.

The product research laboratory conducts research on the physical and mechanical properties of softwood plywood, and explores new treatments and coatings to obtain maximum plywood utilization.

The applied research laboratory develops new construction uses of plywood, carries out testing of new structural systems, and provides engineering assistance to architects and engineers all over the country.

Born and raised in Illinois, Hess graduated from the University of Illinois in 1942 with a degree in architectural engineering. He served as a combat engineer in the Army from 1942 to 1945, attaining the rank of major.

He was employed by Swift and Co. from 1945 to 1951 as an architectural engineer in the construction department. After joining the DFPA, he was field promotion manager in the Chicago region from 1951 to 1955 before being transferred to the technical department. He has been assistant technical director for the past three years.

Robert M. Langmack Co. Appointed Agent

The Robert M. Langmack Company, Los Angeles manufacturers' representative, has been appointed to handle expansion to the West Coast of the aluminum lighting standards department of Read Standard, a division of Capitol Products Corp.

Aluminum lighting standards for every outdoor lighting need—in residential as well as business areas—will be warehoused in Los Angeles to provide prompt service throughout Southern California, Nevada and Arizona.

According to Robert M. Langmack, head of the company bearing his name, Read Standard plans partial fabrication on the West Coast within a year, and complete fabrication within two years.

Read Standard, of York, Pennsylvania, has been a prominent eastern manufacturer for more than a half century. The parent company, Capitol Products Corporation, of Mechanicsburg, Pennsylvania, is internationally known as an extruder and fabricator of aluminum building products.

Specifications and brochures are available on request to the Robert M. Langmack Company, 635 So. Kenmore, Los Angeles 5, Calif.

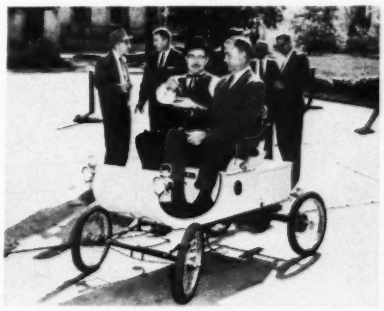
Pfaff & Kendall Names Oregon Sales Agency

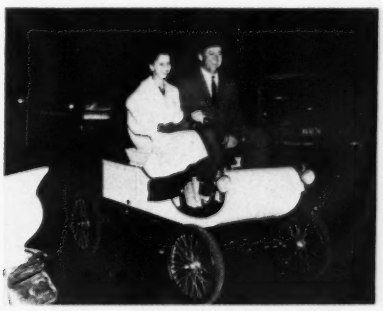
Mr. Forrest E. Pope, Western Regional Sales Manager of Pfaff & Kendall, Newark, N. J., announced the appointment of the Traffic Safety Supply Company of Portland, Oregon as the new sales agency for the State of Oregon. Under the leadership of Mr. Verne Campbell, Sales Manager of Traffic Safety Supply Company, this agency will represent the Pfaff & Kendall Traffic Control Equipment Product line exclusively in Oregon, as well as represent Pfaff & Kendall on the State Highway level for lighting standards.

Verne Campbell

Mr. Campbell's extensive sales management background includes six years with the Standard Oil Company of California in credit and sales and four years with a subsidiary of the Arabian American Oil Company—for two years in Saudi Arabia in administration and for two years in San Francisco in purchasing. In 1953 he became affiliated with The Traffic Safety Supply Company, as estimator and salesman. He was promoted to Sales Manager in 1955, and is now in direct charge of sales for The Traffic Safety Supply Company in Oregon and Washington.

While Chairman Khrushchev visited New York, the Institute of Traffic Engineers was winding up another of its typically American national conventions in the Commodore Hotel, where luncheon for the Russian was held. Drawing for the 1901 Rollsmobile given away at the ITE meeting by Cataphote added a lighter touch to both the serious job of the ITE in attempting to bring better order to America's growing traffic scramble and of statesmen in striving for an improved world political order. Seated at the tiller holding the winning ticket she drew for James V. Musick, Engineer of Traffic and Safety of Ohio Highway Commission, is Mrs. Ruth Petrillo, Scarsdale, N. Y., convention guest. Looking on are other conventioneers and Cataphote's "Gay Nineties Party" hospitality crew. More than 500 ITE members signed up for the drawing.





After Khrushchev had gone back home to Russian-type activity, folks out Columbus way took an American-type interlude to look in on presentation of the vintage car to Traffic Engineer Musick on the State House Mall. After making the presentation, Cataphote Midwest Sales Manager Robert E. Neill (left) transferred derby, weskit, flowing tie, sleeve holders to help Musick establish rapport with his prize. Arriving for an all-American dinner with vivacious Mrs. Musick and friends, Musick had adjusted well enough to wear only the derby. Musick is 1959-60 president of the Ohio Section.

Cataphote Builds New Plant in Canada

The Cataphote Corporation, manufacturer of reflective traffic materials, is opening a new $100,000 Canadian plant for production of reflective glass beads and other materials at Brantford, Ontario.

William H. Searight, President of the corporation, announced that deci-

sion to build production facilities in Canada was made three years ago, and the Brantford location was selected. Construction was begun immediately after ground for the Cataphote Canada Ltd. plant was broken August 20th. Cataphote's main plant, largest in the world manufacturing reflective glass spheres, is in Jackson, Miss. The Canadian plant will supply the growing Canadian markets, as well as the company's foreign warehouses via the St. Lawrence Seaway.

Snow Removal Equipment Works Year Round

The Athey loader pictured here served Rochester, Minnesota for snow removal in winter. It is one of two Athey Force-Feed loaders designed to provide new equipment efficiency and versatility to communities in the "Snow-Belt." Both units are said to

handle year-round municipal loading jobs with assembly-line speed and efficiency—snow, ice, cinders, windrow, stockpile. They provide snow removal speeds up to 20 and 25 cubic yards per minute; other materials 10 and 12 cubic yards per minute. Their chief speed feature is the "full-floating feeder," which gently rises and falls with the contour of the material as it cleans it rapidly down to the street.

One model, the Athey 7-11, discharges directly to the rear; the other, the Athey 125, to either side by a swivelling conveyor. Both are built to streamline municipal loading whatever the job or month.

To get full product information write: Athey Products Corporation, 5631 West 65th Street, Chicago 38, Ill.

Two New Factories For Flex-O-Lite

Two new manufacturing plants, one in St. Thomas, Ontario, Canada and the other in Paris, Texas, are now or soon will be in operation, it has been announced by P. D. Law, President, Flex-O-Lite Manufacturing Coporation, St. Louis.

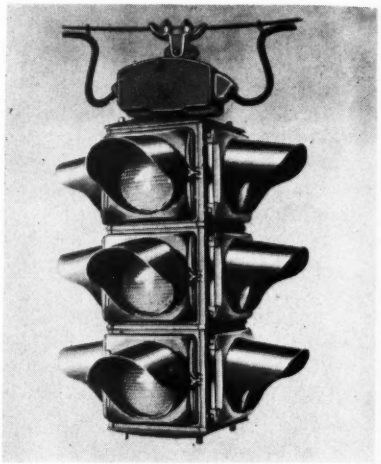
The Paris division, under Flex-O-Lite's Vice President, Don Merseal, will manufacture industrial glass spheres used for reflective purposes in paint, motion picture screens, signs and in the surface treatment of metals.

The Ontario factory will also manufacture glass beads for use in reflectorizing paint for highway marking and traffic signs as well as industrial uses. Henry M. Dawson, President of St. Thomas Metal Signs Limited, is President of the new Canadian company. Other directors are P. D. Law, J. R. Beard, Charles Bland and A. B. Lawrason.

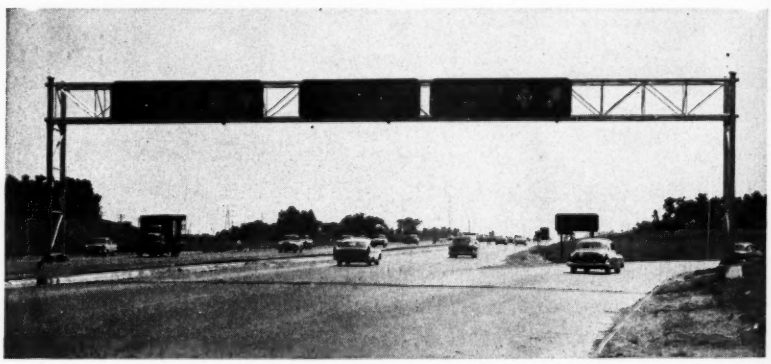
"The combination of the St. Thomas, Ontario; Paris, Texas, and fountainhead St. Louis operation will make the manufacturing concern one of the largest in its field on the North American continent," said Mr. Law.

Traffic Signal Disconnect Hanger

A new disconnect hanger, Type TL-3506, has been designed by Crouse-Hinds Co., Syracuse 1, N. Y., to pro-



vide means for taking down one traffic signal and substituting another in a minimum of time. For cities having a regular program for cleaning and painting traffic signals, this hanger also simplifies installation, the company points out, since it permits hanging the



PLANET SIGN STRUCTURES
Eliminate Maintenance Costs

Planet's all-aluminum sign structures offer maintenance-free support for large overhead signs and lights. No painting is ever required and there are no rust problems. They're durable, too — hurricane force winds have no effect on Planet structures. Erection costs are low, and there's a minimum of traffic interference.

In accordance with your specifications, Planet will build and erect, or build only, overhead sign structures in any size or quantity. Write or call today.

PLANET CORPORATION
• Traffic & Safety Equipment
• Engineered Handling Systems
• Automation Equipment

1842 SUNSET AVENUE LANSING, MICHIGAN

signal after all other electrical work has been completed.

According to the company's report, the hanger replaces the usual wire outlet and serves as a through-feed device or double wire outlet when more than one signal is used on the same span wire. All connections between the signal and its overhead cable are made through a multi-circuit jack connector mounted within the hanger. Thus, the signal may be removed from the hanger without the use of tools, simply by disconnecting it.

Traffic Marking In Plastic

An extruded vinyl strip for traffic marking is being produced by Auburn Plastics, Inc. of Auburn, New York. Used for highway center and border lines, street intersections, railroad crossings, crosswalk marking, school zones, parking lot zoning, airport safety marking and industrial traffic areas both in plant and outside, the plastic material is a lasting replacement for the quickly fading painted lines now in use. According to the company, it is said to be the most economical long term method of road marking.

The reflectorized vinyl material is furnished with an adhesive backing. During installation, additional adhesive is applied to the area to be marked. After the adhesive becomes tacky, the vinyl strip is laid in place and pressed down permanently. The material is easily cut to length and its edge tapered to prevent scuffing. The vinyl material can be produced in many colors; however, black, red, yellow and white will be standard.

The self-cleaning material has a pebble finish created by glass beads incorporated in the material, to furnish both a non-skid and a reflecting surface. The plastic material retains color and is resistant to oil, snow melting materials such as calcium chloride, grease, acid, water, snow and ice.

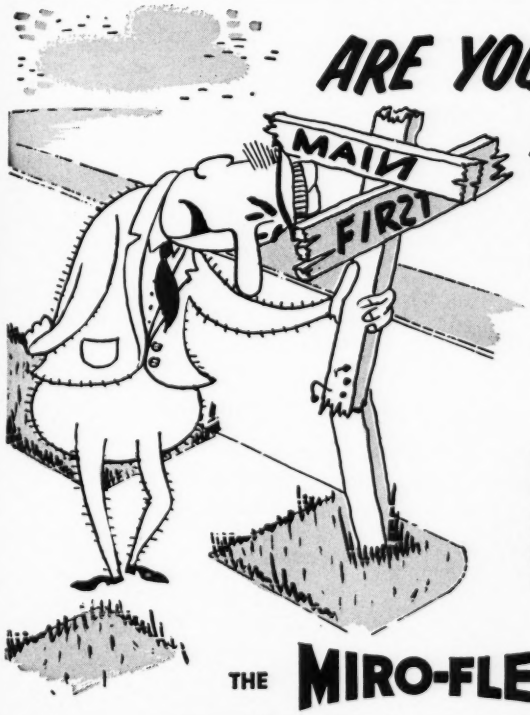
The vinyl strip is available in three widths, 3″, 4″, and 6″ and two thicknesses, .040 for parking lots and industrial use, and .070 for highway and street applications. It is packaged in 150 foot rolls.

HIGHWAY PROGRAM

(Continued from page 12)

Similarly, the elimination of urban highways from the interstate program would force local and state agencies to divert a larger proportion of their tax resources, already under tremendous pressures for other basic public needs, for the construction of the essential connecting arteries to the interstate system. The placing of such an additional burden on local jurisdictions is far from the original intention of the President's highway program.

These past five years have seen an increased glut of traffic congestion in urban areas. They have demonstrated the continued concentration of our population in urban centers. They have confirmed the President's wisdom in recommending, and the Congress' foresight in enacting, what is now the Federal Highway Program. Certainly the program will fail in one of its major purposes if the cities and industrial areas remain strangled with traffic because of lack of needed expanded arterial streets and highways. Therefore, let any reexamination of that program keep in mind the fundamental objective of the program as stated by the President—"a grand plan for a properly articulated highway system" . . . "paying off in economic growth" . . . and making "a good start on the highways the country will need for a population of 200 million people."



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Technical Notes

HOW MANY LIVES WILL CONTROLLED-ACCESS HIGHWAYS SAVE?

As part of a presentation to a Congressional Committee, the National Safety Council prepared an analysis of the safety value of the Interstate Highway System. This interesting and informative analysis is reprinted below.

Projection of recent urban and rural trends in motor vehicle death rates, including the contribution from the very low rates on toll roads and other controlled-access highways, indicates that by 1970 the national rate can be as low as 3.7. This requires, however, that vehicle mileage on controlled-access, modern-design, highways increases as rapidly as the planned construction program will make possible.

Commissioner Armstrong of the U.S. Bureau of Public Roads estimates that if the construction of the Interstate and Defense Highway System continues according to plan, most of it will be in operation by 1970, and it will then be carrying 20 per cent of the national total of vehicle miles, or about 200 billion.

In 1958 toll roads recorded a fatal accident rate of 2.8 per 100 million vehicle miles — approximately one-third of the death rate for all rural highways in 1958. While the experience on some toll roads—particularly in New Jersey and New York — is considerably better than this, a conservative assumption for the Interstate and Defense System highways as a whole is that they will have an average rate of 2.8 each year to 1970.

The recent trend of the rural accident death rate indicates that the rate for other rural roads will decrease from about 7.4 in 1959 to 6.0 in 1970.

With these trends, the life-saving capability of controlled-access, modern-design, highways during the 12 years 1959 - 1970 can be measured. (See Table I.)

The effect of a delay in the Interstate and Defense Highway construction program can be determined from this table. For example, if the whole schedule of work were delayed one year, it can be assumed that the accident experience of 1960 will be similar to that of 1959, and the record for 1970 will be similar to that of 1969. In that case, the estimates of lives saved in each year would be as follows:

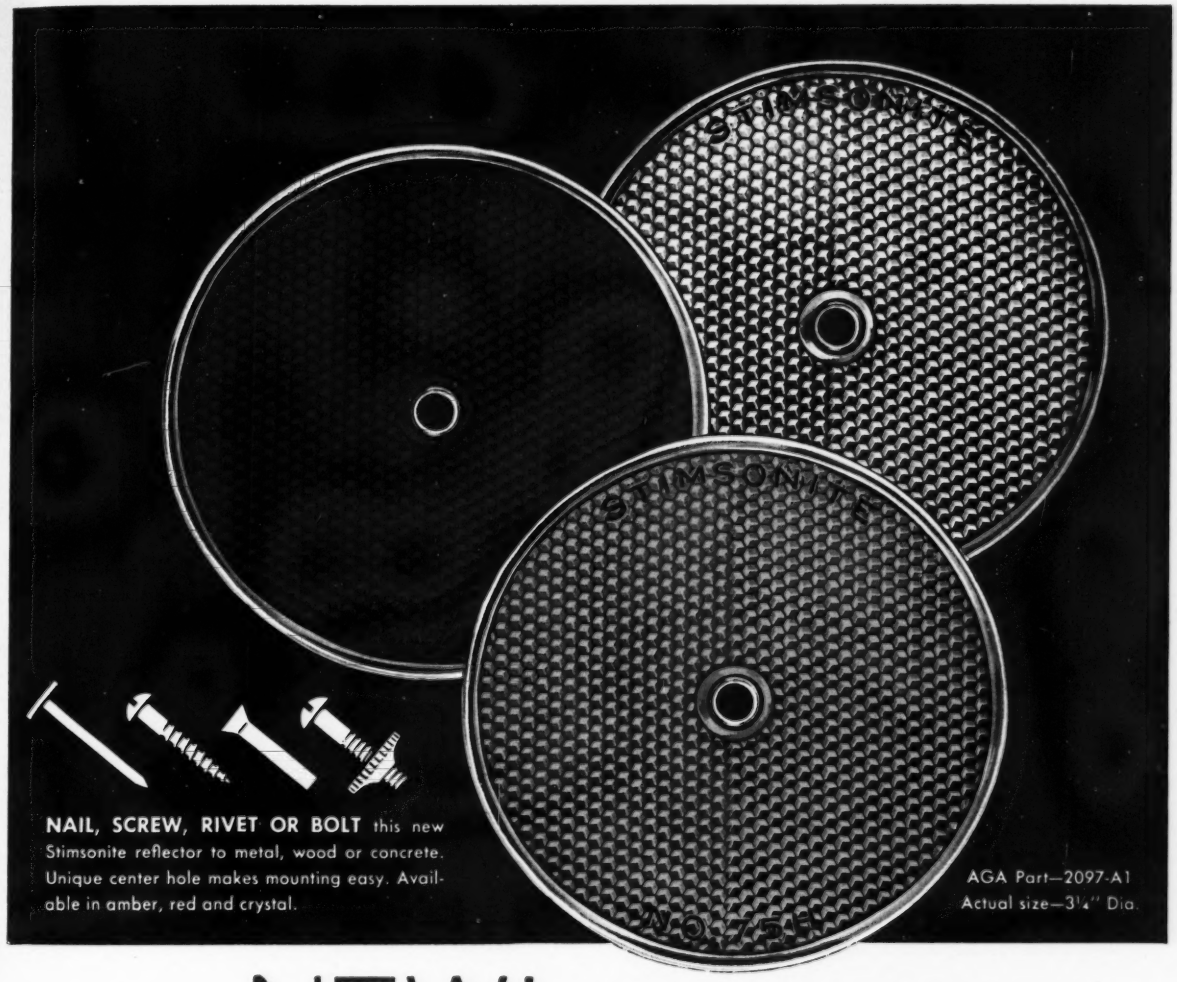
1959	700
1960	700
1961	900
1962	1,100
1963	1,500
1964	1,900
1965	2,450
1966	3,100
1967	3,800
1968	4,600
1969	5,400
1970	5,950
Total lives saved	32,100
Less—lives saved by continued use of Interstate System roads already built	7,300
Lives which can be saved by travel on Interstate System roads if completion delayed one year	24,800

Lives saved during the 12 years 1959-1970 would thus be reduced 5,700 by a one-year delay in the construction program. This reduction in lives saved would never be made up, for in the years after 1970 the number of lives saved would be the same with or without construction delays in the years 1959-1970.

Other assumptions regarding delay in the construction program will yield different amounts of reduction in the total of lives saved. Approximations can be made from the table which, in most cases, will be satisfactory for judging the effect of the delay.

TABLE 1

Year	Vehicle mileage on Interstate & Defense highways if present construction schedule is maintained	Estimated death rate per 100,000,000 vehicle miles for these highways	Estimated deaths	Estimated death rate per 100,000,000 vehicle miles for other rural roads	Estimated deaths for the stated mileage	Difference in death estimates (=lives saved by use of I&D highways)
1959	15 billion	2.8	400	7.4	1,100	700
1960	20 billion	2.8	550	7.3	1,450	900
1961	25 billion	2.8	700	7.2	1,800	1,100
1962	35 billion	2.8	1,000	7.1	2,500	1,500
1963	45 billion	2.8	1,250	7.0	3,150	1,900
1964	60 billion	2.8	1,650	6.8	4,100	2,450
1965	80 billion	2.8	2,250	6.7	5,350	3,100
1966	100 billion	2.8	2,800	6.6	6,600	3,800
1967	125 billion	2.8	3,500	6.5	8,100	4,600
1968	150 billion	2.8	4,200	6.4	9,600	5,400
1969	175 billion	2.8	4,900	6.2	10,850	5,950
1970	200 billion	2.8	5,600	6.0	12,000	6,400
					Total lives saved	37,800
					Less—lives saved by continued use of Interstate System roads already built	7,300
					Lives which can be saved by travel on Interstate System roads if completed on schedule	30,500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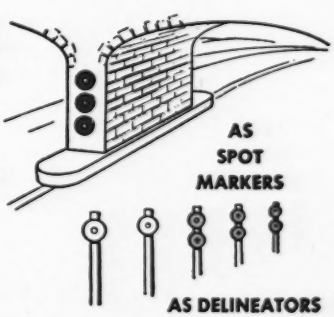

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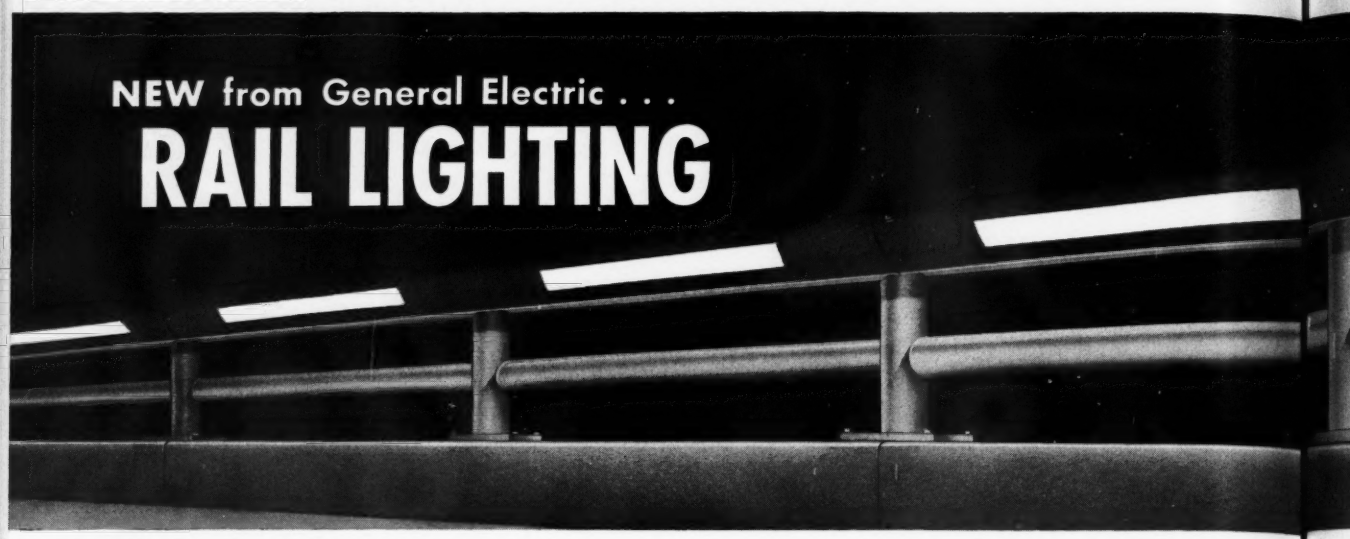

For greater beauty, safety, and efficiency on bridges, overpasses, elevated highways and highway ramps

A fluorescent luminaire combining lighting fixture, bridge rail, and wiring channel all within the rail itself is announced by General Electric. The unit is especially designed for use on applications where mounting and installation pose a problem.

Working with Michael Flynn Manufacturing Company, fabricators of the aluminum rail, G-E engineers developed this unique 12-foot unit, which houses two 42-inch lamps. Built into the rail are all components of the fixture—reflector, socket, lamp, shatter-resistant acrylic window, ballast and wiring channel. The top section of the rail opens to allow easy access to the luminaire and ballast.

These are the benefits with this new concept in lighting:

- Big savings on installation and wiring—simply string out wire, open rail cover, and lay wire in channel.
- Uniformity of light along the roadway.
- Elimination of glare.

Yearbook Changes

AVERY, Eugene V. (Associate)
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BECKENBACH, Col. Charles G. (Member)
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CHAMBLISS, Jack W. (Member)
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FRISCHER, Donald (Junior)
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HOLMES, Robert S. (Member)
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HORINE, Harold H. (Junior)
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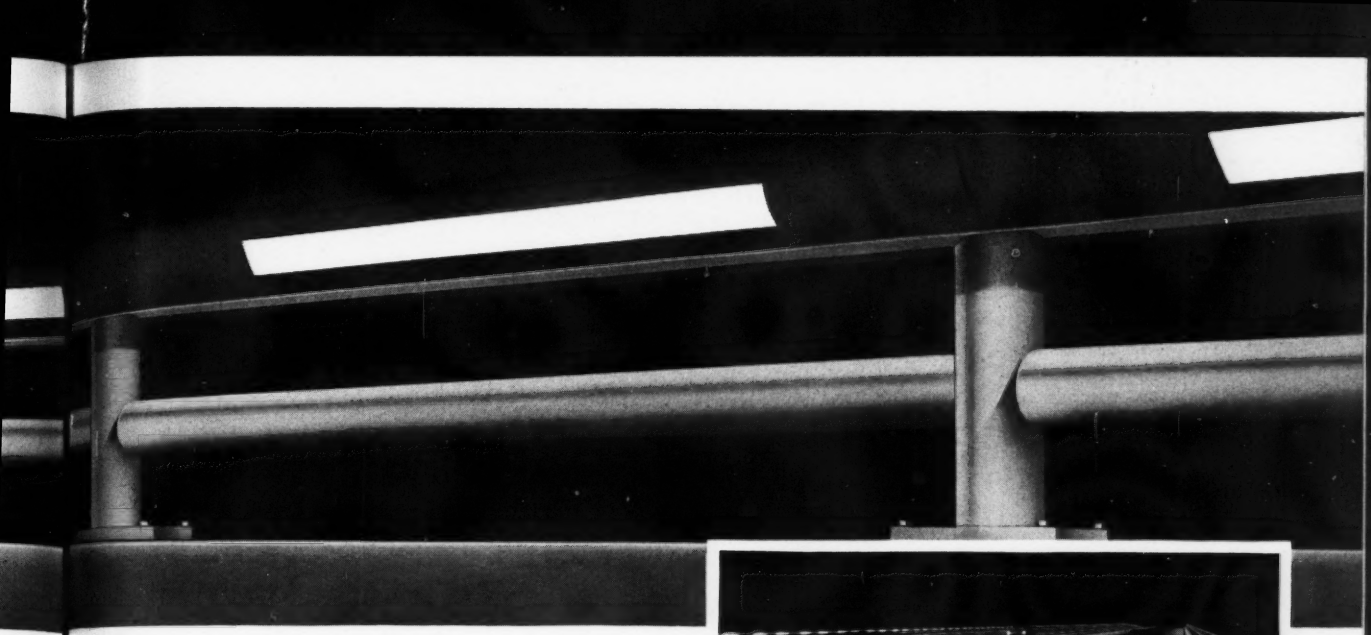
HUFFMAN, Bert M. (Associate)
Traffic Engineer, City Hall, Edmonton, Alberta, Canada. GArden 4-0211

JOHNSON, Arnold A. (Associate)
Asst. Traffic Civil Engineer, Traffic Engineering Division, Arizona Highway Dept., 206 South 17th Avenue, Phoenix, Arizona. ALpine 8-6313, Ext. 276



- Greater visibility in fog, rain or snow.
- Easy "ground-level" relamping and servicing.
- Added beauty—units blend in with rail.

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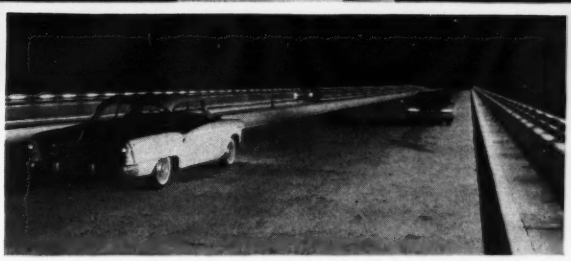

All light from units is directed on the roadway at low level—roadway limits and median strips are clearly defined.

GENERAL ELECTRIC

KARAGHEUZOFF, Theodore T. (Junior)
Assistant Civil Engineer, New York City Traffic Dept., 100 Gold Street, New York 38, N. Y. Terrace 6-8439 SEND MAIL: 637 69th St., Brooklyn 20, New York

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(Continued on page 51)

Institute Affairs

TE Handbook Revision Progress Reported by Editorial Board

The Editorial Board of the Institute of Traffic Engineers has reported substantial progress on the third edition of the Traffic Engineering Handbook. Publication of the new edition is anticipated late in 1960.

The Handbook, long recognized as the most valuable reference volume for traffic engineers, was first published in 1941. A second and revised edition, now out of print, was published in 1950. Nearly 10,000 copies of the second edition have been sold.

Work on the new edition is under the direction of an Editorial Board of the Institute. Chairman of the Board is Robert A. Mitchell, former president of the Institute and currently traffic engineer of Wilmington, Delaware. Members of the Board are: J. E. P. Darrell, traffic engineer of the Minnesota Highway Department; Harmer E. Davis, director of the Institute of Transportation and Traffic Engineering at the University of California; George W. Howie, director of public utilities and traffic in Cincinnati, Ohio; Fred W. Hurd, director of the Yale University Bureau of Highway Traffic; Eugene Maier, traffic engineer in Houston, Texas; Donald M. McNeil, consulting engineer in Pittsburgh, Pennsylvania; and O. K. Normann, deputy assistant commissioner for research, U. S. Bureau of Public Roads.

The Editor of the Handbook, working under the direction of the Editorial Board, is John E. Baerwald, professor of traffic engineering at the University of Illinois. Secretary of the Board is Robert J. Allen, director of the Arizona Traffic Safety Foundation.

Progress to date includes the completion of first drafts of thirteen of the proposed nineteen chapters, as written by individual members of the Institute who were invited by the Editorial Board on the basis of special competence in the particular field of the chapter subject. The remaining chapters are expected in first draft form in the next few weeks. In the meantime, review of the chapters already prepared is being given by the members of the Editorial Board and suggested additions and alterations are being made by the authors.

The nineteen chapters are as follows:

1. Vehicle, Highway and Traffic Facts
2. Vehicle Operating Characteristics
3. The Driver
4. The Pedestrian
5. Traffic Characteristics
6. Traffic Accidents
7. Traffic Studies
8. Roadway Capacity
9. Traffic Marking
10. Traffic Signing
11. Traffic Signalization
12. Parking
13. Loading and Unloading
14. Speed Regulation
15. Other Operational Controls
16. Street and Highway Lighting
17. Geometric Design of Highways
18. Traffic Planning
19. Traffic Engineering Functions and Qualifications.

The headquarters office of the Institute is building up a substantial backlog of orders for the Handbook. No price has been set as yet for the new edition, and probably will not be until the time of publication. It is expected, however, that the cost will be greater than in 1950 when the previous edition was printed.

IMPACT TESTS

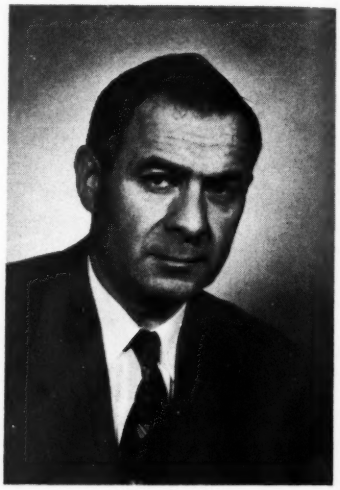
(Continued from page 27)

eral, the 30° angle of impact at 60 m.p.h. produced a transverse impact of 15 to 25 "G" against the left front door, causing the dummy to break the door open. During the initial part of the impact, the guard rail would retain the car door closed, but as the car reflected from the rail, the door would fly open. In most instances the seat belt was the only thing that prevented the dummy from being ejected from the car.

A number of other rather pertinent and interesting observations were made during the crash studies, but space does not permit inclusion of all of these. One rather unique experience was that with the special radio control receiver and relay system, which was used in all 25 crashes, the only damage sustained in the period was the loss of one tube and one wire pulled loose. This is an outstanding record as accelerometers on the car frames occasionally indicated peak decelerations as high as 200 "G."

Sam Osofsky, State Highway Engineer, Dies

Sam Osofsky, 49, an engineer in the California State Division of Highways for nearly 25 years, died October 25.



Sam Osofsky

Osofsky took a temporary job with the division in 1934. In 1936 he was appointed to a permanent position as junior statistician and advanced through the ranks to the position of highway economist, the job he held at the time of his death.

Osofsky is survived by his wife, Pearl, and son, Raymond Carl; his mother, Mrs. Goldie Osofsky; a brother and a sister, Abe and Mary Osofsky, all of Sacramento, Calif.

Osofsky was in charge of traffic studies in the Sacramento area. He had headed similar studies in Modesto, Fresno, Stockton, San Joaquin County; Bakersfield, San Diego and Vallejo, Solano County.

Osofsky was born in New York. In 1919 his family moved to Sacramento, where he attended the public schools, including Sacramento Junior College. He was a 1932 engineering graduate of the University of California in Berkeley.

During World War II Osofsky was a navigator in the air force with the rank of second lieutenant.

In recent years he was recognized as a national leader in applying automation to the processing of highway research data.

Section News

INDIANA SECTION

The Indiana Section of the Institute of Traffic Engineers met at Morgan's Restaurant in Indianapolis, Indiana, on Thursday evening, September 3, 1959.

A number of voting members of the section met during the afternoon and early evening to discuss the recommendations of the ITE workshop. A number of suggestions developed which were to be brought to the attention of the Institute by the officers of the Section.

A dinner was participated in by 24 members and guests and at 8:15 P.M. the regular monthly meeting was called to order by President Cox. Messrs. F. J. O'neal, L. D. Ayres, J. J. Stiles, and Albert Wedeking were introduced as guests.

The Secretary reported that Loren D. Ayres and Richard Childs had been approved as affiliates as of this date by the voting members.

The President reported that the committee which he had appointed to draft a letter which was going to be submitted to the candidates for mayor in the larger cities of Indiana had completed their task and he thanked members White, Sinemus and Stuckey for their efforts.

The President also announced again that members White (chairman), Reyman and Neff had been appointed to the nominating committee. He also announced that the Board of Directors had decided to again assist the Purdue student chapter with their programs and urged all members to accept the invitation to participate.

The Secretary then introduced the speaker of the evening, Fred Morse of West Lafayette, Indiana, the immediate past president of the Indiana Society of Professional Engineers. Mr. Morse presented an informative and interesting discussion on the role of the Indiana Society of Professional Engineers, the relationship of that society to the technical societies, and the responsibilities of engineers to each.

METROPOLITAN (N.Y.) SECTION

A letter from Section President Lou Bender was sent to the members prior to the Oct. 22nd meeting. This meeting was devoted to discussion of the Highland Park Workshop recommendations. The President requested comments and suggestions. He also urged cooperation with New York area engineering colleges in seeing that students get proper traffic engineering courses; close collaboration with professional societies; and members help in furthering research and development.

NEW ENGLAND SECTION

The first meeting for the year 1959-1960 of the New England Section was held in Hartford, Connecticut on October 21, 1959 with 62 members and guests present. Of these 30, mostly students, were from the Bureau of Highway Traffic at Yale University and 10 from the Boston area, the latter traveling over 100 miles to attend this meeting. Following an excellent dinner, there was a short business meeting during which a number of the areas in the Report of the Highland Park Workshop Conference were discussed to determine the general consensus of the group. It was very definite that the New England Section does not approve of Regional or District Meetings as a Biennial Substitute for National Institute Meetings.

The guest speaker of the evening was Alan M. Voorhees, Traffic Planning Engineer, Automotive Safety Foundation, who spoke on "Forecasting Traffic by the Gravity Model Approach." His description of this new and practical method of traffic forecasting was very interesting and instructive and will be long remembered by all.

WESTERN SECTION

Hawaii

Now that Hawaii is a full-fledged member of the Union, the Western Section can boast of having the state with the most pineapples and poi, hula dancers and fresh lava—and incidentally one of the newest State Traffic Divisions.

In June, 1956, Oliver K. Wong was appointed Acting Traffic Engineer for the Territorial (now State) Highway Department. Mr. Wong is a 1958 graduate of the Bureau of Highway Traffic of Yale University. He holds a BS degree in civil engineering from the University of New Hampshire.

As the first head of a new Traffic Division, Mr. Wong has been working under the direct supervision of the Deputy Highway Engineer, John C. Myatt.

Generally speaking, Hawaii's highways compare favorably today with those of any Mainland state. However, they will begin to lag behind unless the Islands win their fair share of Federal highway grants. Hawaii pays her full share of Federal taxes on motor vehicle operations, but does not share in the benefits of the National Interstate and Defense Highway System. As a result, the Islands have been paying millions more in automotive taxes than they have been receiving in Federal highway benefits.

MEMBERSHIP COMMITTEE

John A. Bruce, Chairman; Lou Kisseleff, L. B. Thompson, Dudley Stevens, Jack Henberger, James P. Angell, Robert W. Cromellin, Howard Huget, Roy B. Sawhill.

The main objectives and activities of the Membership Committee are as follows:

1. Provide better contact with professionally qualified persons in local areas concerning matters of national and Western Section membership status.
2. Provide necessary membership application forms.
3. Guide and assist new members.
4. Maintain the needed local area files to discharge the responsibilities under the above listed objectives.
5. Make necessary membership reports to the Secretary-Treasurer, the Executive Board, and the Section Annual Meeting.

Statistics reported by the Membership Committee to the Annual Meeting indicate that the Western Section is growing at a slightly faster rate than National ITE:

Membership Statistics	National ITE	Western Section
Total, 5-23-58	1,133	195
Total, 5-23-59	1,231	225
Increase, 1959/1958	10.9%	11.5%

The Membership Committee, in its annual report to the Section, recommended that all members should continue membership contact work with special emphasis on those who are National members but not members of the Western Section. The policy of being careful so as to secure only qualified members should be continued.

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Bay Area

The Bay Area held a dinner meeting in South San Francisco on Sept. 10. Thirty-two members and guests attended. After libations and solid food, Ross Shoaf reported on the Seattle convention. He noted that the resolutions adopted by the Bay Area concerning the formal organization of Areas within the Western Section, and concerning the establishment of a California Coordinating Committee were approved in principle and were to be studied by the Constitution and By-Laws Committee of the Western Section. Ross has appointed Ed Hall, (San Diego) to be chairman, Wolf Homburger (Bay) to be Vice-Chairman, and Charles Zell (Sacramento) and John McDonald (Los Angeles) members of a study group to prepare ideas about the California Coordinating Committee. Wolf, who arrived out of breath directly from seeing Ed Hall, said that the Study Group would meet in Sacramento on October 7th and would probably hold an open meeting on the following day to elicit ideas and feelings of California ITE members regarding statewide coordination. He pointed out that coordination was the primary objective to be achieved and that it was not planned to set up a committee with policy-making powers.

Bob Jaffe was selected as General Chairman of the 1960 Western Section Convention to be held in the week of July 18, 1960 at the Jack Tar Hotel in San Francisco. Assignments to working committees are being made.

In other business, a resolution was passed unanimously which put the Area on record "as opposing the installation of YIELD RIGHT OF WAY signs at entrance ramps to limited-access highways, and urges the elimination of this requirement from the signing standards required by the Bureau of Public Roads for the Interstate System." The Area feels that any right of way problems at such locations can best be solved by amending the vehicle codes of the various states to show that a merging area is *not* an intersection governed by the normal right-of-way rule.

Jim Gibson of the Public Utilities Commission reported on his attendance at the Fourth International Study Week in Traffic Engineering held at Copenhagen in 1958, at which over 600 persons from 37 countries were present. The problems faced by other countries are essentially the same as those in the U. S., but increasing at a faster rate due to the accelerating sales of automobiles. Each of the countries also indicated an awareness that the overall movement of people is the primary problem to be faced rather than moving motor vehicles. The bicycle is also a problem of major concern abroad.

Jim Gibson also mentioned the recent P. U. C. decision resulting from a change in the California Vehicle Code which provides that no commercial vehicles will have to stop at minor spur railroad crossings. A list of these crossings was to be submitted to each municipality by the P. U. C.

Other Bay Area news: Welcome to Tom Blalock, who has attended some of our past meetings, to membership in the ITE. Jack Navone has replaced John Forristal as Traffic Engineer of Alameda County. Among those who were lucky enough to make it to New York to the ITE Convention were Ross Shoaf, Marty Wallen and Jim Kell. Jim, still hammering away at the problem of YIELD signs, presented a report of his ITE committee on this subject.

Parking restriction and meters in Sausalito will soon be in operation on Saturdays and Sundays as well as during the week. Art and gift stores, catering primarily to visitors, have their busiest days during the weekend and have created an acute parking problem.

An overhead signal control system will be installed on the six-lane Golden Gate Bridge. It will be used for reversible lane control during morning and evening peak hours, and also to indicate lanes closed due to accidents, breakdowns or maintenance work.

San Diego

A luncheon business meeting of the San Diego Area members was held at noon on Sept. 9, at the Engineering Building in Balboa Park. Nine members and one guest were in attendance. A full schedule of business was conducted.

Charles Strong represented the San Diego Area at the National Engineers' Week organizational meeting. The San Diego Area ITE sponsored a booth in last year's Engineers' Week exhibit. This year we again intend to have a booth, plus participate more fully in other activities conducted during National Engineers' Week—Feb. 21-27, 1960.

Jim Reading is preparing a short course in traffic engineering with emphasis on traffic safety. The course is designed for the police and engineering staffs of the San Diego Area cities. A good representation is expected. The course instructors will come from the local ITE membership. The exact date has not been set as yet but should be announced soon.

The City of San Diego is inaugurating its Meter Maid program and change over to 10¢ per hour parking on October 1. Part of the girls' indoctrination program was a four-hour course on the traffic engineering aspects of parking. Ed Hall, Marty Bouman, Don Robbins, Charles Strong and John Tsiknas took part in the presentation. Marty Bouman's entire Operations Section is presently involved in the major task of changing the parking meter signs throughout the City of San Diego and converting the parking meters to accept nickels and dimes only.

Paul Fowler's County Traffic Engineering crew is involved in a Major City Street Master Plan for the unincorporated cities of Vista and Lemon Grove. Vista's present population is over 16,000 and Lemon Grove (which adjoins San Diego on the east) has approximately 20,000 people.

Arizona-New Mexico

The Accident Analysis Section of the Arizona Highway Department has published a yearly accident report and an additional preliminary research report on the application of statistical control techniques in determining above normal accident rate sections on the state highway system.

The plans and specifications for a revised lighting system in the Queen Creek Tunnel on U. S. 60 are complete. Highly modern fluorescent lighting will be installed in the tunnel, which is approximately one quarter mile long.

Renewed effort is being made by the Arizona Highway Department to initiate construction on additional sections of the interstate system. In the Phoenix area, about 12 miles of the Phoenix Interstate Freeway will be under contract by next year at this time if anticipated schedules are met.

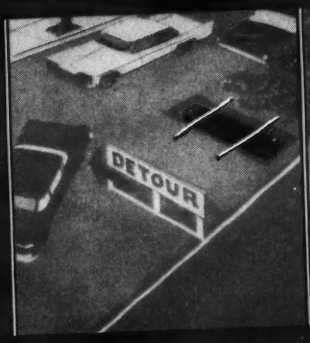
From the City of Phoenix Chuck Haley is now back from an extended vacation and reports that he will install a reversible lane procedure on a one-mile section of arterial

(Continued on page 50)

"He says the sign will offer a considerable amount of protection in the event of a northwest snowstorm."

here are 8 reasons why the ELECTRO-MATIC RADAR VEHICLE DETECTOR solves more traffic signal problems:

1.



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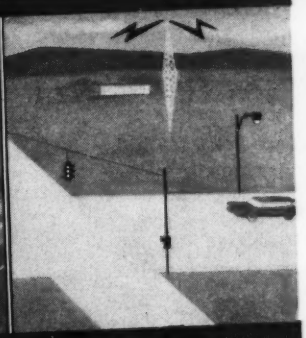

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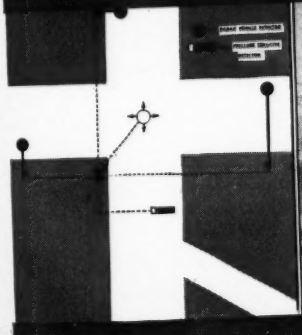

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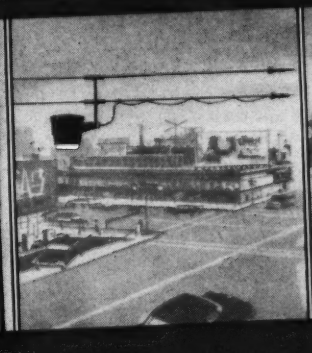

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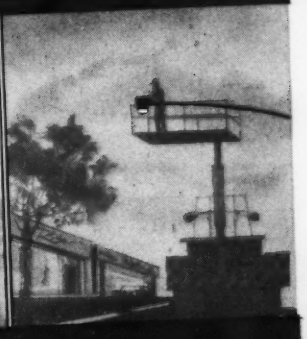

8.

AUTOMATIC SIGNAL DIVISION

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MOTOR VEHICLE DEATHS AND CHANGES

Month	DEATHS 1956	1957	1958	1959	PERCENTAGE CHANGES Corresponding Month 1956-1959	1957-1958	1958-1959	4 Months Moving Ave.* '57-58	'58-'59
January	2,954	2,882	2,770	2,830	— 4%		+ 2%		— 1%
February	2,652	2,508	2,360	2,380	—10%		+ 1%		— 1%
March	2,940	2,843	2,560	2,760	— 6%		+ 8%		+ 1%
April	2,970	2,933	2,580	2,680	—10%		+ 4%		+ 4%
May	3,094	3,065	3,010	3,220	+ 4%		+ 7%		+ 5%
June	3,338	3,302	3,000	3,150	— 6%		+ 5%		+ 6%
July	3,555	3,308	3,210	3,340	— 6%		+ 4%		+ 5%
August	3,535	3,635	3,450	3,450	— 2%		0%		+ 4%
September	3,653	3,365	3,330	3,330	— 9%		0%		+ 2%
9 Months	28,691	27,841	26,270	27,140	— 5%		+ 3%		
October	3,476	3,466	3,600			+ 3%		— 1%	
November	3,603	3,620	3,510			— 4%		— 1%	
December	3,858	3,775	3,620			— 3%		— 1%	
Total	39,628	38,702	37,000						

*Four Months Moving Average is based on changes between the totals for four months instead of one month. For example, the July figure shows the change between the totals for April-July 1958 and April-July 1959, etc. Adding several months together tends to smooth out single month changes which may be affected by differences in the number of weekends in a month from one year to the next, random variations, etc.

All 1956 and 1957 figures are from the National Office of Vital Statistics.
The 1958 and 1959 figures are National Safety Council estimates.

TRAFFIC NEWS

(Continued from page 31)

Swiss Highway Growth Inspires New Plan

Switzerland's tremendous growth in both domestic and international road traffic resulted in a new road plan passed by the federal government.

The plan for the first time authorizes the building of roads by the federal government. Previously, only lower levels of the Swiss government could build roads and available funds on these levels precluded the building of expensive modern expressways.

Last July, as the result of a campaign by the Swiss Road Federation, a referendum was held and the Swiss voted five to one to allow the federal government to build roads.

Immediately, a plan for new highways, drawn up with the advice of the Swiss Road Federation was presented and adapted to the road program by the government.

Under the new program, a national road network 1,037 miles in length will be constructed, most of it between 1960 and 1970. It will cost (US) $675.9 million. A later program to supplement these roads with more connections will cost $209 million.

The new Swiss roads will be incorporated into the International E-route network.

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Chicago Builds New Fourteen-Lane Road

By 1962, Chicago will have a five-mile, (US) $110-million superhighway with fourteen traffic lanes. Unique in the United States, the highway will consist of two single-directional divided roadways separated by "rapid transit" facilities for public transportation.

There will be seven lanes in each direction on the fourteen-lane segment of the road. Four lanes will make up the inner expressway and three will be used as an outer "collector" expressway.

The fourteen-lane section will run from 26th St. to 47th St. on Chicago's South Expressway. The road will narrow to ten lanes from 47 St. to 67 St.

Ninety per cent of the cost will be paid by the Federal government, because the expressway will be part of Interstate Route 90.

—*World Highways*

Ralph F. Gross Attends Conference in Paris

Ralph F. Gross (Mem. ITE) was the only American city official present at the 3rd Congrés De l'Union Internationale Des Transports Publics. There were 27 nations represented, including Japan and Ceylon. Mr. Gross addressed the Congress on its opening day.

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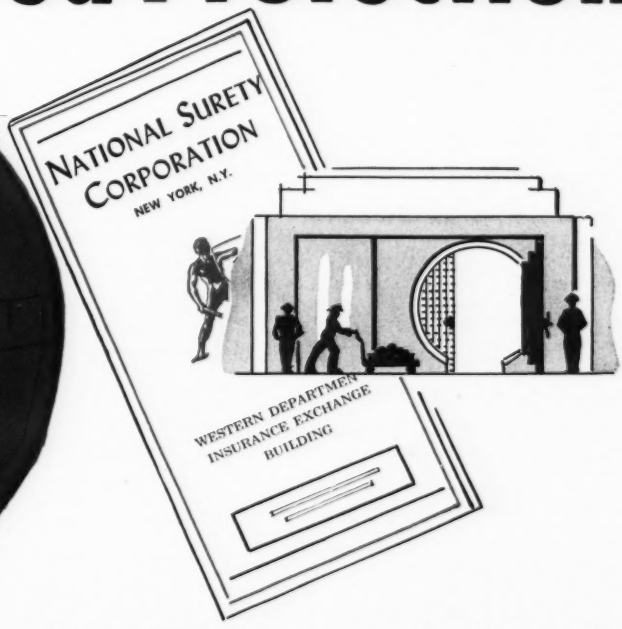

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SECTION NEWS

(Continued from page 46)

street. This particular street is 36 feet wide and will work quite satisfactorily using the center lane as reversible. In addition, 1,000 new speed limit signs will be installed in newly annexed areas of the city within the next four months.

In Albuquerque a PR system installation has been progressing since early summer; the old "scramble" is being replaced by the "Waco Sequence."

Oregon

The Oregon Area was well represented at the Annual Meeting of the ITE in New York. Those attending were Bruce Crandall, Al Head, Bob Blensly, and Bob Conklin from the Oregon State Highway Department, and Bill Weller and Fred Fowler from the City of Portland. Also present were ex-Oregonians George Howie, Carlton Robinson and Dave Schoppert. Bob Conklin, who won the Past President's Award, presented his paper at the meeting.

Los Angeles

Members from the Los Angeles area who were in attendance at the National Meeting in New York include:

Harry Parker, Los Angeles County; Sam Taylor & Family, City of Los Angeles; Red Matthews, Econolite; Cliff Clark, Los Angeles County.

Jim Ray, formerly of Santa Ana, is now Traffic Engineer for Sacramento County. Les Frink of Santa Barbara has taken over the T. E. position in Fresno, and Neal Clark has forsaken Glendale to go to work for his former boss, Al Hutchison, in the City of L. A.

James L. Ray of Coverdale & Colpitts is returning to the home office in New York after a 3-year tour of duty in Los Angeles.

Guy McDonald reports that Los Angeles County is completing the major redesign of the intersection of Gage, Slauson, and the off-ramp of the Santa Ana Freeway. This project includes the realignment of Gage, major channelization in Slauson, the installation of traffic signals and a new sign bridge. (Incidentally, this is the County's first sign bridge installation.) The project is complete except for the sign bridge, which has been delayed because of the steel strike.

Inter-Mountain

Representatives from the Inter-Mountain Area to the National ITE Convention in New York included Bob O'Connell from Wyoming, Vealess Hudspeth from Colorado, Lou Kisseleff and Jack Shockey from Denver, Jim Challis from Salt Lake City, and Jack Noblitt from Utah.

Denver, Pueblo, Salt Lake City, and the State of Colorado received National Safety Council awards for Traffic Engineering during 1958. The awards for Denver and Colorado were presented at the first Area meeting held in Denver on October 23.

Denver and the Colorado State Highway Department are working at top speed with construction of a new cloverleaf interchange at Colfax Avenue and Federal Boulevard. At present there is quite a state of confusion in that the Phone Company seems to be in the way of the Water Department crews—the Water Department is in the way of the contractor—and all three are in the Traffic Department's way.

Gus Byrom has recently purchased a new applicator for applying reflective sheeting. He is also experimenting with left turn pockets on one of Aurora's wider boulevards with the use of paint channelization.

Joe Lacy has recently begun experimenting with non-signalized midblock crosswalks in the Central business district of Englewood. They seem to be working quite well, but the public is still hesitant to take chances against 300 horsepower.

Highway lighting is being installed in several communities in Utah. Approximately $20,000 worth of materials is on order for Mt. Pleasant, $25,000 worth for Payson City, and $30,000 for Heber City.

Utah has now adopted a policy of eliminating the steady red indication along with a green arrow when a signal head is provided for each lane on multi-lane facilities.

An unusual and interesting problem has arisen in Utah. A tunnel which normally carries two-way traffic has a low clearance; consequently, high loads, if they stay in the proper lane, hit the supporting members along the sides of the tunnel. The plan is to signalize the tunnel so that when a high load approaches the flow will be one-way on the road through the tunnel.

Sacramento

Jim Ray, the former traffic engineer of Santa Ana, is the new traffic engineer of Sacramento County. Welcome, Jim and your charming wife, Mary Jane, to our group. We also welcome into our Area Leslie Frink, former traffic engineer of Santa Barbara and now traffic engineer of Fresno.

Washington

Don Strombom is leaving the Planning Division of the Washington State Highway Department Oct. 1 to take the position of Traffic and Planning Engineer for King County. Don received his Bachelor and Master's degrees in Civil Engineering from Washington State University, spent two years as an officer in the Army and completed the traffic course at Yale before coming to the Highway Department as an Assistant Highway Engineer in June 1958.

Phil Brown, who has been on leave from the Planning Division of the Highway Department since January to manage the Oyster House in Olympia for his father, is now back in the fold.

The guest speaker at the Sept. 15 meeting was Wes Bogart, Limited Access Engineer for District 1 of the Highway Department. The subject was: Problems in Location and Design of the Rural Section of Seattle-Tacoma Freeway, from the Pierce-King County to the South City Limits of Seattle.

Although Mr. Bogart is not yet an ITE member he would be a good addition to this traffic engineering group. It is hoped that he will find time to fill in that ITE application that has been in his desk drawer for so long.

A Do-It-Yourself Regional Transportation Study for the Puget Sound Area is presently being organized by a technical committee headed by Squeeg Glaze of the Highway Planning Division. This committee composed of city and county engineers and planners will guide the study. Each of the four participating counties — King, Pierce, Snohomish and Kitsap—are to provide data for the study.

SOUTHERN SECTION

Virginia Division

COMMITTEES. The following committees have been appointed by President Wilkinson:

Program Committee
Fenton Jordan, *Chairman*

Nominating Committee
Kenneth W. Smith, *Chairman*;
Fenton Jordan and J. L. Thomas

By-Laws Committee
W. H. Gordon, Jr., *Chairman*;
J. D. Sink and R. A. Hubbard

Audit Committee
W. N. Ferro, *Chairman* and
J. E. Field, Jr.

Positions Available

JOLIET, ILLINOIS

Position: Traffic Engineer.

Requirements: B.S. in engineering from accredited institution. Specialized schooling and experience desirable. Capable of assuming full responsibility and charge of Traffic Section in the City Engineering Department. Population — 65,000.

Salary: $7,000. minimum.

Apply: J. H. Rohlf, Acting City Manager, City Hall, Joliet, Illinois.

CITY OF SAN DIEGO, CALIFORNIA

Position: Assistant Traffic Engineer — to perform traffic flow and accident analyses, prepare traffic signal timing schedules and diagrams, and conduct field investigations of street lighting and traffic control devices.

Requirements: Equivalent to graduation from college with major work in engineering and two years of traffic engineering experience.

Salary: $587 to $713 per month depending upon qualifications.

Apply: (Before January 5, 1960) City Civil Service Commission, Room 453, Civic Center, San Diego 1, California.

WISCONSIN HIGHWAY COMMISSION

Position: Traffic Survey Engineer — Traffic Engineering Department.

Duties: Traffic assignment analyses; review of geometric design plans.

Requirements: Degree in Civil Engineering with graduate work in traffic engineering desirable; 3 years' experience.

Salary: Starts at $535 plus $78 cost-of-living bonus; merit increases; start at salary above minimum possible for applicant with advanced degree.

Apply: Rohland F. Milhaupt, Personnel Officer, State Highway Commission, State Office Building, Madison 2, Wisconsin.

KNOXVILLE, TENNESSEE

Position: Traffic Engineer on the staff of the Metropolitan Planning Commission of Knoxville and Knox County, with prospect of ultimately heading a separate department of traffic.

Requirements: Professional Traffic Engineer who can assume responsibility for developing a traffic engineering program in the metropolitan area.

Salary: $7,500 to $8,500 a year depending upon the qualifications.

Apply: Mr. Joe B. Whitlow, Metropolitan Planning Commission, P. O. Box 1646, Knoxville, Tennessee.

LIGHTING ENGINEER

Position: Electrical Engineer.

Requirements: Experienced in highway lighting and qualified to design and approve highway lighting specifications and plans.

Apply: Box 1259, Institute of Traffic Engineers, 2029 K Street, NW, Washington 6, D.C.

YEARBOOK CHANGES

(Continued from page 43)

SHIRRA, Graham F. (Junior)
Senior Planner & Traffic Engineer, Ogden City Planning Commission, Municipal Building, Washington Blvd., Ogden, Utah. EXport 3-4169

STROMBOM, Donald A. (Junior)
Planning & Traffic Engineer, King County Engineers Office, 907 County-City Building, Seattie 4, Washington

TAYLOR, Grady J., Jr. (Associate)
Highway Engineer, Howard, Needles, Tammen & Bergendoff, 1805 Grand Ave., Kansas City 8, Missouri. BAltimore 1-6900 SEND MAIL: 4951 Outlook, Mission, Kansas

THOMAS, Richard C. (Associate)
Sr. Asst. Traffic Engineer, Div. of Traffic Engineering & Parking, 1404 E. 9th Street, Room 400, Cleveland 14, Ohio. TOwer 1-4600, Ext. 507 SEND MAIL: 452 Lombardy Drive, Berea, Ohio

TSIKNAS, John C. (Associate)
Associate Traffic Engineer, City, Engineering Bldg., Balboa Park, San Diego 1, California. BE 9-7511, Ext. 313

VOORHEES, Alan M. (Member)
Traffic Planning Engineer, Traffic Engineering Division, Automotive Safety Foundation, 200 Ring Building, Washington 6, D. C. REpublic 7-6395, Ext. 33

WALKER, E. L., Jr. (Associate)
City Traffic Engineer, Traffic Engineering Dept., 211 East Green St., High Point, North Carolina. TUcker 2-9226

WECKESSER, Paul M. (Junior)
Senior Traffic Engineer, Bureau of Traffic Control, City, 6 University Avenue, Rochester 5, New York. BAker 5-8455 SEND MAIL: 1214 Clinton Avenue South, Rochester 20, New York

WELLONS, William B. Jr., (Junior)
Director of Traffic Engineering & Safety, South Florida Division, American Automobile Association, Miami, Florida. SEND MAIL: 15315 S. W. 82nd Court, Miami 57, Florida

WELTY, William R. (Member)
Supervising Traffic Engineer, Texas Highway Dept., 11th & Brazos Streets, Austin 14, Texas. GReenwood 6-9101

WHITE, Frank T. (Associate)
Associate Highway Engineer—Planning Department, California Division of Highways, District IV, 150 Oak Street, San Francisco, California. UNderhill 3-0222 SEND MAIL: 2600 Woolsey St., Berkeley 5, California.

WICKSTROM, George V. (Associate)
Supervising Traffic Engineer, Penn-Jersey Transportation Study, Room 1601, Philadelphia State Office Bldg., 1400 Spring Garden St., Philadelphia 30, Penna. LOcust 8-4000 SEND MAIL: 8 Rumson Rd., Kendall Park, Franklin Park, New Jersey.

WILLIAMS, Earl C. Jr., (Member)
Chief of Traffic Engineering Division, Montgomery County, County Office Building, Rockville, Maryland. POplar 2-3216.

WIXSON, Charles T. (Affiliate)
7527 Pinehurst Avenue, Dearborn, Michigan. LUzon 2-4663

WONG, Oliver D. K. (Junior)
Traffic Engineer, Hawaii State Highway Dept., Highway Building, Punchbowl Street, Honolulu 13, Hawaii. 50511, Local 361 SEND MAIL: 3019 Gulston Street, Honolulu 16, Hawaii.

WRIGHT, J. E. (Associate)
Traffic Survey Manager, Texas Highway Department, P. O. Box 5051, West Austin Station, Austin 31, Texas

YOUNG, James T. (Junior)
Sr. Engineering Assistant, Traffic Engineering, Texas Highway Department, P. O. Box 6868, 2501 Southwest Loop, Fort Worth 15, Texas. WAlnut 6-1711

MEMBERSHIP APPLICATIONS

The Institute of Traffic Engineers welcomes applications from qualified traffic engineers, but does not desire as members persons who are unqualified. Listed below are the names of those from whom applications for membership or transfer in grade have been received since the last published list. Institute members are urged to review this as soon as possible and immediately inform the Executive Secretary's office if names of people are found who are known to be unqualified for ITE membership or transfer.

NEW APPLICATIONS

ALBERT, Russell
Assistant District Traffic Engineer, Washington State Dept. of Highways, 450 Spokane Street, Seattle, Washington. October 6, 1959 for ASSOCIATE.

ANDREWS, James A. C.
Group Leader, Foundation of Canada Engineering Corp., Ltd., 1425 West Pender Street, Vancouver, B. C., Canada. September 3, 1959 for ASSOCIATE.

ANTHONY, Floyd L.
Regional Design Engineer, U. S. Bureau of Public Roads, 2938 E. 92nd Street, Chicago 17, Illinois. September 1, 1959 for ASSOCIATE or MEMBER.

CARTER, Everett C.
Highway Engineer, Trainee; Virginia Department of Highways, Traffic & Planning Division, 1221 East Broad Street, Richmond, Virginia. October 9, 1959 for JUNIOR.

CHADWICK, Dean Orville
Deputy Traffic Engineer—City, P. O. Box 1293, Albuquerque, New Mexico. October 23, 1959 for ASSOCIATE.

DILLON, Glen E.
District Traffic Engineer, Division of Highways, State of California, 150 Oak Street, San Francisco, California. October 8, 1959 for ASSOCIATE.

GALATI, Joseph V.
Assistant Traffic Engineer—City, Room 212 City Hall, Harrisburg, Pa. October 19, 1959 for JUNIOR.

GROTHE, Oscar R.
Highway Design Engineer, U. S. Bureau of Public Roads, Regional Office, 2938 E. 92nd Street, Chicago, Illinois. September 8, 1959 for ASSOCIATE.

MYATT, John C.
Deputy State Highway Engineer, C. E. VIII, Hawaii State Highway Department, 869 Punchbowl Street, Honolulu 13, Hawaii. October 13, 1959 for MEMBER.

NAVONE, Jack L.
Traffic Engineer—Civil Engineer III, Alameda County, 1225 Fallon St., Courthouse, Oakland 12, California. September 22, 1959 for JUNIOR.

PLINE, James Leonard
Traffic Technician, Idaho Department of Highways, 603 Main Street, Boise, Idaho. October 19, 1959 for JUNIOR.

SURTEES, Harold E.
City Traffic Engineer, Christchurch City Council, City Engineer's Office, Christchurch, C.1, New Zealand. October 2, 1959 for JUNIOR.

VICK, Columbus Edwin, Jr.
Graduate Research Assistant, Department of Engineering Research, North Carolina State College, Raleigh, North Carolina. October 28, 1959 for JUNIOR.

WUESTEFELD, Norman H.
Traffic Engineer, Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut. October 13, 1959 for JUNIOR.

YAMANAKA, Henry M.
Civil Engineer IV, Illinois Division of Highways, 160 N. La Saile St., Chicago 1, Illinois. October 30, 1959 for JUNIOR.

APPLICATIONS FOR TRANSFER

HENRY, Ellis C., Jr.
Traffic Commissioner, City Traffic Division, Room 327 City Hall, St. Louis, Mo. October 28, 1959 for MEMBER.

PRATT, Charles O.
Associate Traffic Engineer, Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut. October 26, 1959 for ASSOCIATE.

SHARP, James A.
Assistant Traffic Engineer, City, 223 James Avenue, Winnipeg 2, Manitoba, Canada. August 4, 1959 for MEMBER.

WADE, Philip Edward
Highways Analysis Engineer, Ontario Department of Highways, Parliament Building, Queen's Park, Toronto, Canada. October 19, 1959 for ASSOCIATE.

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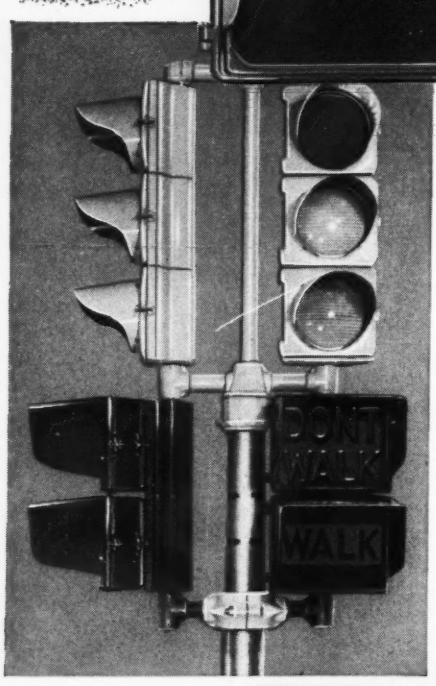

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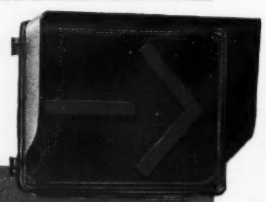

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Automatic Signal Division of Eastern Industries	47
Carpenter Manufacturing Company	45
Cataphote Corporation	8
Crouse-Hinds Company	52
Douglas Fir Plywood Association	28 & 29
Duncan Parking Meter	49
The Eagle Signal Corporation	10
Flex-O-Lite Manufacturing Corporation	5
General Electric Company	42 & 43
Hercules Powder Company	3
Minnesota Mining & Manufacturing Company	2
Miro-Flex Company, Inc.	39
Pfaff and Kendall	6
The Planet Corporation	38
Prismo Safety Corporation	Back Cover
Radiator Specialty Company	51
B. G. Reilly Company	33
Rockwell Manufacturing Company (Dual)	53
Southern Signals, Inc.	4
Time-O-Matic, Inc.	17

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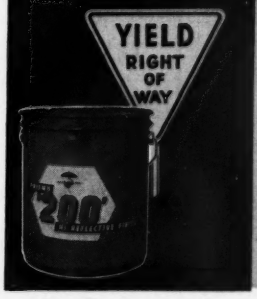

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